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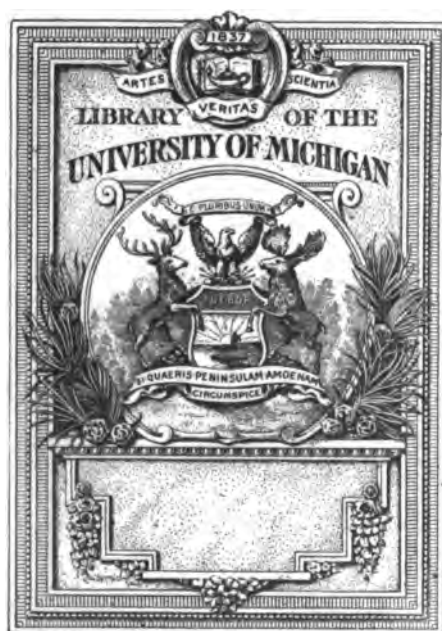
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FIG. 4.



Sporotrichosis of forearm. Note cicatricial areas surrounding sinuses leading to muscles and discharging seropus. (See page 208.)

FIG. 8.



Indolent ulcers converted into the classical healing variety by the celomel-adhesive-plaster method. Note firm, bright-red granulations and encircling broad band of bluish-white, rapidly regenerating epithelium. Straps curled back for sketch. (See page 210.)

INTERNATIONAL CLINICS

A QUARTERLY

OF
ILLUSTRATED CLINICAL LECTURES AND
ESPECIALLY PREPARED ORIGINAL ARTICLES
ON
TREATMENT, MEDICINE, SURGERY, NEUROLOGY, PÆDIAT-
RICS, OBSTETRICS, GYNÆCOLOGY, ORTHOPÆDICS,
PATHOLOGY, DERMATOLOGY, OPHTHALMOLOGY,
OTOLOGY, RHINOLOGY, LARYNGOLOGY,
HYGIENE, AND OTHER TOPICS OF INTEREST
TO STUDENTS AND PRACTITIONERS

BY LEADING MEMBERS OF THE MEDICAL PROFESSION
THROUGHOUT THE WORLD

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CONTENTS OF VOLUME III

(TWENTY-THIRD SERIES)

DIAGNOSIS AND TREATMENT

	PAGE
THE PROPHYLAXIS AND TREATMENT OF MALARIAL INFECTIONS. By CHARLES F. CRAIG, M.D.....	1
REMARKS ON A CLINICAL STUDY OF UNCINARIASIS AND ITS TREATMENT. By BAILEY K. ASHFORD, M.D., Sci.D.....	28
ON THE TREATMENT OF PNEUMONIA. By NORMAN B. GWYN, M.B....	42
THE DIAGNOSIS AND TREATMENT OF GASTRIC AND DUODENAL ULCERS. By BOARDMAN REED, M.D.....	95
TREATMENT OF DISEASES OF THE HEART. By ALBERT ABRAMS, A.M., M.D.	108
THE TREATMENT OF PULMONARY TUBERCULOSIS BY HYDRO- THERAPY. By SIMON BARUCH, M.D.....	116
PRACTICAL POINTS IN THE MANAGEMENT OF SOME PULMONARY DISEASES. By JOHN BESSNER HUBER, A.M., M.D.....	127
THE NEWER MEDICINAL AND NON-MEDICINAL DIURETICS. By THOMAS LINN, M.D.....	142
HYPOCHLORHYDRIA AND ITS TREATMENT. By J. CASTAIGNE, M.D...	146
TREATMENT OF THE COMMON VEGETABLE PARASITIC DISEASES OF THE SKIN. By FRANK CROZER KNOWLES, M.D.....	151

MEDICINE

GASTRO-INTESTINAL TOXÆMIA—ITS CAUSE AND TREATMENT: WITH A CRITICISM OF INTESTINAL STASIS (Lane). By PETER DANIEL, F.R.C.S. (England).....	159
ALIMENTARY TOXÆMIA. By EDRED M. CORNER, M.C., F.R.C.S. (England).	201

SURGERY

INTERESTING SURGICAL CASES. By P. G. SKILLERN, JR., M.D.....	204
ACUTE OSTEOMYELITIS OF THE LUMBAR VERTEBRÆ: DEATH FROM PYÆMIA. By ASTLEY P. C. ASHHURST, M.D., and WILLIAM H. WADS- WORTH, M.D.	214
THE USE OF CAMPHORATED OIL IN SURGERY. By P. BAUDET, M.D..	224
ANÆMIA FROM A SURGICAL STANDPOINT. By HENRY T. BYFORD, M.D.	227
THE TREATMENT OF ACUTE PERITONITIS. By C. P. THOMAS, M.D...	234
SUPPURATIVE PYLEPHLEBITIS. By CHARLES R. ROBINS, M.D.....	240

MEDICOLEGAL

RAPE IN CHILDREN AND IN YOUNG GIRLS. Part II. By GURNEY WILLIAMS, M.D.	245
--	-----

ELECTROTHERAPEUTICS

THE USE OF CERTAIN PHYSICAL AGENTS IN THE TREATMENT OF CANCER AND ALLIED DISEASES: (1) ELECTROCOAGULATION (DOYEN); (2) FULGURATION (DE KEATING-HART); (3) THER- MORADIO THERAPY (DE KEATING-HART). By WILLIAM SEAMAN BAINBRIDGE, A.M., Sc.D., M.D.....	268
BERGONIE TREATMENT OF OBESITY AND CARDIOPATHY. By FRANCIS HOWARD HUMPHREIS, M.D. (Brux.), F.R.C.P. (Edin.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), L.M. (Rot. Dublin), London.....	286

LIST OF ILLUSTRATIONS TO VOLUME III

(TWENTY-THIRD SERIES)

COLORED PLATES

Sporotrichosis of forearm (Fig. 4).....	<i>Frontispiece</i>
Indolent ulcers converted into the classical healing variety by the calomel-adhesive-plaster method (Fig. 8).....	<i>Frontispiece</i>

PLATES, CHARTS, DIAGRAMS, AND FIGURES

	PAGE
Anopheline breeding ground in a colonial cantonment (Fig. 1).....	4
Anopheline breeding places near a native village (Fig. 2).....	4
Training a stream to prevent the formation of breeding places for mosquitoes (Fig. 3)	5
The same stream after completion of the work and after several floods (Fig. 4)	5
Method of applying petroleum to stagnant streams (Fig. 5).....	5
A well-screened dwelling-house (Fig. 6).....	6
A properly-screened sleeping porch (Fig. 7).....	6
Chart showing the decrease of deaths from malarial fever in Italy. (After Celli.) (Fig. 8).....	18
Chart showing the decrease in malaria in the Canal Zone. (From Sanitary Report of the Board of Health of the Canal Zone, 1913.) (Fig. 9).....	19
The mountains at Utüado covered with coffee plantations (Fig. 1).....	28
A coffee bush loaded with beans. Note the shade tree whose trunk is the chief part visible. In the shade of these bushes earth-soiling is common (Fig. 2)	29
Group of patients suffering from uncinariasis (Fig. 3).....	32
Group of patients, field hospital, Utüado (Fig. 4).....	33
Field hospital for treatment of selected cases of uncinariasis, Utüado (Fig. 5)	33
Group of country people in Utüado awaiting in line for the purpose of having their faeces examined previous to treatment for uncinariasis (Fig. 6) ..	36
Temperature chart of hospital patient suffering from pneumonia (Fig. 1)...	45
Method of applying kuatsu in the reviving of unconscious persons (Fig. 1) ..	113
A simple form of apparatus for the application of the needle-bath (Fig. 1) ..	121
Perforated ulcer of soft palate; syphilitic (Fig. 1)	204
Ulcer of tongue; tuberculous (Fig. 2).....	204
Syphilitic osteoperiostitis of phalanges of middle finger (Fig. 3).....	205
Sessile wart of thumb (Fig. 5).....	208
Wart of foot (Fig. 6).....	208
Leg ulcer due to <i>Bacillus coli</i> , simulating syphilitic ulcer (Fig. 7).....	209
Ulcer of knee; syphilitic (Fig. 9).....	210
Tumor over the upper part of the anterior tibiofibular compartment (Fig. 10)	211

	PAGE
Upon active extension of the foot, the bulging alters its shape (Fig. 11)	211
Liquid glass dressing for fracture of phalanx of little toe (Fig. 12)	211
Charts of patients suffering from acute osteomyelitis	215, 217, and 219
Fulguration (de Keating-Hart) outfit: <i>A</i> , Generating apparatus. <i>B</i> , High-frequency apparatus. <i>C</i> , Sterilizing and cooling apparatus. <i>D</i> , de Keating-Hart electrode (Fig. 1)	274
Bainbridge metal operating table (Fig. 2)	274
Case I, condition of patient before operation (Fig. 3)	275
Case I, condition after treatment (Fig. 4)	275
Case II, condition of wound December 2, 1911 (Fig. 5)	275
Case II, condition when discharged from hospital, December 20, 1911 (Fig. 6)	275
Case II, condition May 1, 1913 (Fig. 7)	278
Case III, growth upon admission, January 13, 1912 (Fig. 8)	278
Case III, condition of wound on January 27, 1912 (Fig. 9)	278
Case III, condition October 9, 1912, with denture in place (Fig. 10)	278
Case IV, growth before operation, February 7, 1912 (Fig. 11)	279
Case IV, condition on November 15, 1912 (Fig. 12)	279
Case V, condition upon admission to hospital, January 8, 1912 (Fig. 13)	279
Case V, condition on March 4, 1912 (Fig. 14)	279
Case V, condition October 14, 1912, three weeks before death (Fig. 15)	280
Apparatus for electrocoagulation (Doyen), diathermy (Nagelschmidt), and thermoradiotherapy (de Keating-Hart): <i>A</i> , transformer. <i>B</i> , switch-board. <i>C</i> , table. <i>D</i> , indifferent electrode. <i>E</i> , active electrode, in an insulating handle (Fig. 16)	280
Diagram showing the effect of hot air, bipolar voltaization with sparks, and electrocoagulation on living tissues (Fig. 17)	282
Case VI, condition of patient when operated, October 31, 1912 (Fig. 18)	281
Case VI, condition on April 14, 1913 (Fig. 19)	281
Thermoelectric apparatus for measuring the temperature of the tissue in thermoradiotherapy: <i>A</i> , needle being heated in copper vessel (<i>B</i>). <i>C</i> , needle, for plunging into tissue. <i>D</i> , galvanometer. <i>E</i> , thermometer for showing temperature of water (Fig. 20)	281
Arrangement of the electrical apparatus for the giving of the Bergonié treatment in obesity and cardiopathy (Fig. 1)	290
Two oscillographic tracings; in the upper one the current and the interrupter are working harmoniously, while in the lower figure the converse is true (Fig. 2)	292
Chart showing loss of weight in a patient treated by the method of Bergonié (Fig. 3)	296

Diagnosis and Treatment

THE PROPHYLAXIS AND TREATMENT OF MALARIAL INFECTIONS

BY CHARLES F. CRAIG, M.D.

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THE discovery by Laveran of the parasites concerned in the etiology of the malarial fevers, and by Ross of the method of transmission of these parasites from man to man by the mosquito, has placed the prophylaxis of malaria upon a firm scientific basis; while the introduction of cinchona and its alkaloid, quinine, has given us a specific in the treatment of these infections. In many countries these facts have been taken advantage of in extensive campaigns against malaria, and such campaigns have met with success in proportion to the thoroughness with which measures based upon the facts have been put in operation.

While the prevention of malarial fevers is of vital importance in many regions of our own country, especially in the States bordering upon the Gulf of Mexico and the Mississippi River, it must be admitted that we have accomplished but little in the prophylaxis of these fevers. Many localities in these States are practically uninhabitable by reason of the severity of the malarial infection there present, while in others the inhabitants lead a wretched existence, made miserable by frequent and repeated attacks of malarial fever. Within recent years much money and labor have been expended in an effort to eradicate the hook-worm from infected districts in the United States, but very little has been accomplished, or even undertaken, in the eradication of malarial disease, of vastly greater importance, in my opinion, than hook-worm infection.

The economic importance of malaria cannot be overestimated. It is evident that a people suffering from earliest infancy from malarial disease can never be as productive, either mentally or physically, as a people free from such infection, other things being equal. A survey of the most malarious regions of the world amply demonstrates this fact. Occupations requiring strength and endurance, such as agriculture and mining, cannot be efficiently prosecuted by a people whose physical vigor is sapped by frequent attacks of malarial fever, while the peculiar localization of the malarial plasmodia in the capillaries of the brain, so frequently observed, furnishes an anatomical reason for lack of initiative and ambition in the victims of this insidious disease, and the continued toxæmia of chronic infection is another cause of the inertia of the inhabitants of malarial localities. On these grounds the prophylaxis of malarial fevers becomes of the utmost economic importance to the people of regions where malaria is endemic, and should be as carefully and efficiently carried out as any other hygienic measure. In those portions of our country where malaria is known to be prevalent as much care should be devoted to its eradication as is expended upon a pure water supply, the prevention of diseases like typhoid, yellow fever, and smallpox, or any other public sanitary measure.

THE PROPHYLAXIS OF MALARIAL INFECTIONS

The prophylaxis of malarial infections, to be successful, must rest upon a thorough knowledge of the etiology of the disease. It is now known that these infections are transmitted from man to man by mosquitoes belonging to the *Anophelinae*, and that before the mosquitoes become infected they must first have bitten an infected man. We also know that in both man and mosquito the plasmodia undergo a definite life-cycle, which, if interrupted at any stage, will result in their death. So far as we know, the malarial plasmodia exist only in man and in certain species of mosquito, so that it is unnecessary to consider other animal or insect hosts in the prophylaxis of these infections. Therefore, it follows that if it were possible to destroy all malaria-carrying mosquitoes, or kill all the plasmodia in the blood of every infected individual, we should succeed in eradicating malarial infections in every locality. While this

is possible theoretically, we must admit that in practice it is generally impossible, hence we are forced to combine methods both for the destruction of the mosquito and the plasmodia.

The methods adopted in any region must depend upon the local conditions, and common sense must be used here as in every other procedure for the prevention of disease. High-flown theories must give place to a calm study of the situation and the means best adapted to fight the situation in that particular locality. In some regions we may be able practically to destroy all mosquitoes and thus prevent the spread of the infection, while in others this may be impossible, and quinine prophylaxis will have to be substituted, together with measures for the protection of man from the bite of the mosquito. In most localities the best results will be obtained by the combination of most of the methods described in this communication; and I am but little in sympathy with those who insist that on the destruction of mosquitoes or the prophylactic use of quinine alone we must depend for the eradication of malarial fevers.

In this paper the methods of prophylaxis against malaria will be considered under the following headings:

1. Destruction of the mosquito.
2. Protection from the bites of mosquitoes.
3. Isolation of the infected individual.
4. The prophylactic use of quinine.
5. Proper treatment of carriers of the infection and of initial infections.
6. Education of the public.

DESTRUCTION OF THE MOSQUITO

The destruction of the mosquitoes transmitting malaria involves a knowledge of their life-history and of the methods which have been found most efficient in preventing their development or in destroying them. They may be attacked during the larval, pupal, or adult stage, but the most effective methods are those employed during the larval and pupal stages. When it can be done, the destruction of mosquito breeding places is the most valuable prophylactic we possess against malaria; but in many regions the most we can do is to reduce the number of insects, as it is impossible to reach all of the breeding

places. In such regions it is necessary to combine other prophylactic measures with those looking to the destruction of the mosquitoes. These insects may be prevented from developing or may be destroyed by either physical, chemical, or biological methods, and the particular measure adopted must depend upon the local conditions. The most important measures may be classed as physical; *i.e.*, the destruction of breeding places by means of levelling, drainage, and clearing. These measures call for the expenditure of large sums of money and demand the support of local, State, or even national authority, and the cordial coöperation of the sanitarian and the people to be benefited. When such measures can be carried out they are really the most valuable that we possess in the fight against malaria, and in the vast majority of infected regions are capable of greatly reducing, if not entirely eradicating, malarial disease; and the expense involved, although often very great, will be more than repaid by the results obtained.

If possible, all breeding places of mosquitoes should be drained, and if this is impracticable, such localities may often be filled in and thus large areas of swamp land reclaimed. Too often the expense involved is practically prohibitory, and other prophylactic measures have to be employed; but it is often surprising to find that what at first appeared a most expensive undertaking is really actually accomplished with the expenditure of but a small amount of money compared with the expected cost of operations. The character of the breeding places of the *Anophelinæ* varies with the different species. Some breed only in clear, slowly-running water, while others breed in any collection of water, both in natural surroundings and in water barrels, cans, and other utensils found about residences. Some breed in brackish water, while others require fresh water. Therefore, a very careful survey must be made of each region in order to determine just what species of mosquito are present and just where they are breeding, before an estimate is made of the expenditure necessary to destroy their breeding places (Figs. 1, 2, 3, and 4).

In conjunction with filling in and draining the breeding places of mosquitoes, the removal of brush along the banks of streams or drains, or any shelter for the mosquitoes such as is furnished by jungle, long grass about residences, or clumps of trees surrounded at their base by bushes or long grass, is advisable. The removal of the

FIG. 1.



Anopheline breeding ground in a colonial cantonment. (After Major Fowler.)

FIG. 2.



Anopheline breeding places near a native village. (After Major Fowler.)

FIG. 3.



Training a stream to prevent the formation of breeding places for mosquitoes. (After R. Ross.)

FIG. 4.



The same stream after completion of the work and after several floods. (After R. Ross.)

FIG. 5.



Method of applying petroleum to stagnant streams. (After Sergeant.)

vines so often observed enclosing the porches of houses in malarial regions, and of the ornamental shrubs with which residential grounds are frequently dotted, will result in a great diminution in the number of mosquitoes and, consequently, in the prevalence of malaria in such localities.

A great deal may be accomplished in the prophylaxis of malaria by careful attention to the sanitation of the home. The importance of the removal of all receptacles that may furnish a breeding place for the mosquito, as tin cans, broken or unscreened drains or water barrels, broken bottles, and unscreened water tanks and wells, should be taught the public. It has been stated by some theorists that the *Anophelinæ* do not breed in small collections of water, as in tin cans, broken bottles, etc., but this is not true, for I have often observed them breeding in such receptacles, and even in the little puddles of water found in bamboo posts that have been cut off just above a joint. While most of the species of *Anophelinæ* prefer to breed in the woodland, they can adapt themselves to almost any breeding place, and this fact should not be forgotten in searching for their breeding places.

Various chemicals have been used for the destruction of mosquitoes in both the larval and adult stages of development, but such measures are merely a compromise, as they would be quite unnecessary if it were possible to get rid of the breeding places. Among the chemical methods that have been found most effective may be mentioned the oiling of the breeding places with kerosene or some admixture of oil and other material that will destroy the larvæ of the mosquitoes by preventing them from coming to the surface of the water to breathe. The quantity of kerosene should be about one ounce to every fifteen square feet of surface to be covered, and enough should be used to cover the entire surface of the breeding place. Collections of water thus treated should be most carefully inspected at frequent intervals, as the layer of oil becomes easily displaced by currents in the water, by winds, or by the movements of aquatic animals. This method of prophylaxis should never be resorted to if it is possible to drain or otherwise destroy the breeding places of the insects (Fig. 5).

A large number of chemicals have been advocated from time to time as serviceable in the destruction of adult mosquitoes, but for

household use it is probable that none of them exceeds pyrethrum powder in value, and sulphur fumigation when it is desirable to kill the mosquitoes in vessels or in an entire house. The methods of employing these agents will be found described in treatises on the malarial fevers, and will not be considered here.

A measure for mosquito destruction that has been largely overlooked and which is really valuable is the catching of the insects in traps. These traps are placed in the walls or under the roofs of houses, and so arranged as to face the prevailing winds if we wish to catch the ordinary *Culex* mosquito, but Orenstein found on the Isthmus of Panama that more malarial mosquitoes (*Anophelines*) are caught if the traps are placed in the lee of building. The mosquito traps should be so arranged that they can be removed each morning, and the mosquitoes killed by exposing them to the fumes of sulphur or pyrethrum powder. Trapping of mosquitoes is especially useful where it is impossible to get rid of the breeding places because of local conditions, or where the mosquitoes breed at a great distance and fly into settlements, for it has been definitely determined that these insects may fly for long distances, as first demonstrated by the writer in the Philippines. A flight of over a mile is frequently observed, and even a two-mile flight is far from uncommon.

The biological means available for the destruction of mosquitoes consist in stocking collections of water that serve as breeding places with fish that will devour the larvæ. Certain species of fish are very active in this direction, the ordinary stickleback or sunfish being one of the most efficient. Other biological methods consist in the introduction into the breeding places of vegetable organisms capable of infecting and destroying the larvæ, or of insects that feed upon the larvæ or the adult mosquito. While these methods are interesting from a scientific standpoint, they are of little practical value, and should not be considered if other and better modes for the destruction of the insects can be instituted.

The ideal method for the extermination of malaria in any locality is the complete destruction of the breeding places of the mosquitoes that transmit the infection, but this is rarely possible, therefore it is necessary to combine other means of prophylaxis with this ideal method if we are to attain the fullest measure of success.

FIG. 6.



A well-screened dwelling-house. (After Bostock.)

FIG. 7.



A properly-screened sleeping porch.

PROTECTION OF MAN FROM THE BITES OF MOSQUITOES

Where it is impossible to destroy all the breeding places of mosquitoes the protection of man from the bites of these insects becomes a most important prophylactic measure. This is secured by proper screening of habitations, the use of head nets and gloves, of mosquito nets for the bed, and of various odorous substances which are smeared upon the skin for the purpose of preventing mosquitoes from biting.

The screening of habitations in regions where malarial fevers are endemic is a most important and valuable prophylactic measure, and one that should always be insisted upon when economic reasons do not absolutely prohibit it. Unfortunately, in many of the worst malarial regions the people are too poor to bear the expense of screening, and, under such circumstances, the use of the bed net proves a valuable substitute. The screening used for houses should be of mesh fine enough to keep out all the *Anophelinæ*, and it has been found by experiment that netting containing sixteen meshes to the inch will accomplish this purpose. However, in regions that are infected with yellow fever, or that may become infected, this netting is not suitable, for it permits the yellow fever mosquito, *Stegomyia fasciata*, to go through, and in such regions netting used for screening houses should contain eighteen meshes to the inch. The arrangement of the screens will vary, of course, with the architecture of the building, but window screens should always be placed outside the window sashes, so that the windows may be raised or lowered without disturbing the screens. The doors are best protected by a double screened porch door, and all the netting should be of copper wire, if possible. If iron wire must be used it should be protected by two coats of good paint; otherwise, iron screens will soon rust out. Where wire screening is impossible the windows and doors may be protected by screens made of cheesecloth, which are satisfactory if carefully watched for the appearance of holes and promptly replaced (Figs. 6 and 7).

Where habitations cannot be efficiently screened, the use of the mosquito net for the bed should be insisted upon, for this alone, when properly used, has resulted in a great reduction in the malarial rate. The bed net should contain at least sixteen meshes to the inch and should have a border of muslin deep enough to protect the body when reclining, as otherwise the mosquitoes may bite through the net if the

individual happens to lie against it when sleeping. The net should be tucked under the mattress instead of being allowed to hang loosely around the bed; this prevents the insects from getting inside the net from under the bed. Good bed nets can now be obtained at very moderate cost, and are invaluable in the prophylaxis of malaria.

Where exposure to mosquitoes is necessary by reason of travel or duty, as in the case of soldiers on guard at night, etc., the use of head nets and gloves is recommended for protection against bites. These are much better than the use of substances smeared on the skin, but have the objection that they are hot and uncomfortable. However, it is doubtful if the discomfort arising from their use equals that suffered during an attack of malaria, and when one considers the danger to life this slight discomfort appears a trifle.

Various substances have been recommended for protecting the skin from the bites of mosquitoes. Among the best may be mentioned the oils of citronella, pennyroyal, eucalyptus, and anise; camphor, vaseline, and kerosene. While, under certain circumstances, these agents may prove valuable, they are really miserable makeshifts, and not to be depended upon as prophylactics. All are used by smearing them upon the exposed skin, the application being renewed as needed.

ISOLATION OF THE INFECTED INDIVIDUAL

The isolation of patients infected with malaria in order to prevent reinfection from the mosquito or the infection of the mosquito is generally neglected by the physician. This measure is a most important one from the standpoint of prophylaxis, for every malarial patient should be regarded as a reservoir of infection and should be treated accordingly. The forms of the malarial plasmodia which are intended to complete their development within the mosquito are usually detected in the blood of man in from eight to ten days after the appearance of clinical symptoms, but in many instances these forms, or *gametes*, are present even before symptoms have developed, and in many others they are found during relapses of the infection. When found, the patient is infective to the mosquito and should be so isolated that no mosquitoes can reach him. To accomplish this he should be placed in a screened room or ward, and should be kept there until the blood examination is negative for *gametes*. If it is

impossible to put him in a screened room, he should be obliged to use a bed net and remain beneath it during the early evening and night. Not only is this measure necessary to prevent infection of mosquitoes, but to secure the safety of the patient, as it will protect him from reinfection by mosquitoes already infected or that he has himself infected.

In advocating this measure it is understood, of course, that in many instances it is difficult, and even impossible, of execution. The resistance of the *gametes* to quinine demands a long isolation which can only be obtained under circumstances which make absolute control of the patient possible. Thus, in the military service, or in great engineering projects such as the Panama Canal, it is possible to keep malarial patients isolated until they are no longer dangerous as carriers of the disease; but, under ordinary conditions, the most we can hope to do is to isolate the patient until he has recovered from his symptoms, and then give him careful directions regarding the continued use of quinine. If initial infections are properly treated, patients will not become carriers of the infection, and isolation will be unnecessary.

THE PROPHYLACTIC USE OF QUININE

Perhaps no subject in the prophylaxis of the malarial fevers has given rise to more controversy than the use of quinine as a prophylactic. Enthusiasts in its favor have claimed that the use of this drug alone is all that is needed to eradicate malarial infections, while its most violent enemies have claimed that it is practically useless, and even harmful. The truth evidently lies between these extreme opinions, and it is my belief that quinine prophylaxis is a most valuable aid in the prophylaxis of malaria, but only an aid. To deny the efficacy of quinine in prophylaxis is absurd, for if the drug cannot kill the plasmodia during the incubation stage of malaria it certainly cannot kill them during the paroxysms of the disease. If quinine is a specific for malarial fevers it is equally a specific in preventing their development; but experience has shown that large doses are required in order to prevent the development of an infection in badly-infected regions, and that these doses must be continued indefinitely, as there

is always danger of reinfection where quinine prophylaxis is relied upon to the exclusion of measures for destroying the breeding places of mosquitoes. The most ardent advocates of quinine prophylaxis have claimed that by this method it is possible to rid a community of malaria; and, while this is theoretically possible, in practice it can only be true in very rare instances, and where the universal use of the drug could be enforced. Such results could be obtained only by the administration of quinine in sufficient dosage to every individual in the infected locality for an indefinite period; since so long as *Anopheles* were present, just so long would there be danger of the spread of infection from imported cases of the disease. Quinine prophylaxis is a measure of the very greatest value in the fight against malaria, but it has its limitations and cannot be depended upon to the exclusion of measures for the destruction of mosquitoes.

The dose to be administered, the method of administration, and the form of the drug most useful in prophylaxis vary with almost every observer, and it is difficult to decide just which mode of administration is best. Quinine is given by the mouth, either in solution or in capsules or troches. Celli claims that in Italy troches of tannate of quinine have proven the best method of administering the drug, and certainly no other observer can speak with as great authority regarding quinine prophylaxis as can this enthusiastic and successful worker in the field. He recommends from five to six grains of quinine (0.3 to 0.4 Gm.) every two days. I have found that in regions where only tertian and quartan infections are endemic a daily dose of five grains (0.3 Gm.), given just before retiring, is in most instances sufficient to prevent infection, but where the æstivo-autumnal infections occur larger doses must be given. In the vast majority of exposed individuals, a dose of 10 grains (0.65 Gm.) taken upon retiring every third, sixth, and ninth night for two weeks after reaching the infected region, and the same amount every fifth night thereafter, will give good results.

In most sections quinine prophylaxis need not extend throughout the year, for a malarial season is clearly marked in almost every tropical and subtropical locality, while in the temperate zones malaria occurs only during certain definite months in the year. Thus, quinine prophylaxis should be resorted to only during the seasons when malarial infections are prone to occur, and omitted during non-

malarial seasons, or when infections are few in number. The continued use of quinine in the dosage recommended is not hurtful in most cases, but, of course, in individuals showing an idiosyncrasy to the drug it cannot be used in prophylaxis.

It is possible that the daily use of small doses of quinine favors the development of resistant strains of the plasmodia, and for this reason I do not favor the administration of doses of from one to two grains daily (0.06–0.12 Gm.) as recommended by some authorities. I do not believe that these small doses are effective as a prophylactic, and I am very sure that they would favor the development of quinine-resisting strains of plasmodia if such were possible. Quinine prophylaxis has proven so valuable in many localities that it cannot be dismissed from consideration by the mere statements of its enemies, but it is well to remember that it is a method that should be combined with others designed to effect the destruction of the mosquito. The experience in Italy with this method of prophylaxis has proven its usefulness, and, as in Italy, the drug should be supplied by the State to those too poor to purchase it for prophylactic purposes.

PROPER TREATMENT OF "CARRIERS" OF THE INFECTION AND OF INITIAL INFECTIONS

One of the most important, and yet one of the most neglected, prophylactic measures against the spread of malarial infection is the discovery and treatment of "carriers" of the disease. It is well known that after a malarial infection has persisted for from eight to ten or more days in man forms develop that are capable of still further development in the mosquito, and these eventually render the insect infective to man. These forms are called "*gametes*," and they can be easily detected in the blood of man by microscopic examination. It is also evident that if these *gamete* carriers can be found, and the *gametes* killed, they will cease to be infectious to the mosquito; but, despite this knowledge, this most important procedure in the prophylaxis of malaria has been absolutely neglected save in a few localities where malarial infections have been studied by experts upon the subject. It has been shown that the *gamete* carriers can be rendered harmless by proper treatment with quinine, therefore it is feasible to employ the drug in this way as a prophylactic against the disease. It

has also been shown that many individuals have plasmodia in their blood days, or even weeks before symptoms of infection appear, and it is of great importance that these latent infections be discovered and treated. By the term "latent infection" we include both those individuals in whom no malarial symptoms have ever developed, and those in whom the disease is latent between recurrences, provided the plasmodia may be demonstrated in the blood.

It is well known that in all malarial regions a considerable proportion of persons apparently in good health show malarial plasmodia in their blood, and are really carriers of the infection. These individuals possess a certain immunity to the toxins of the plasmodia, so that while symptoms are frequently absent they are not immune to the plasmodia. It is therefore obvious that while such people are fortunate in possessing an immunity to the malarial toxin or toxins, they are actually a great menace to the health of a community, as they are carriers of the plasmodia, and are thus able to infect mosquitoes.

In most regions in which malarial fevers occur to any great extent a large majority of the children are sufferers from latent malarial infection and are carriers of the disease, but it has been shown that adults also are infected in large numbers; so that in order to discover the exact percentage of latent malaria in any locality it is necessary not only to examine the blood of the children but also of the adult population. It would be unprofitable here to detail the results of the many observations that have been made upon latent malaria in various localities, but in order to show how frequently such infections are encountered, and the relative percentages at various ages, I have compiled the following table from the observations of numerous investigators, including my own at Camp Stotsenburg, in the Philippines, where 72.5 per cent. of the children between the ages of one and five years were shown to have latent infections, and 62.2 per cent. of the adult native population showed such infections.

Age	No. examined	No. infected	Per cent. infected
1 to 5 years.....	1684	502	29.8
5 to 10 years.....	1645	463	28.1
10 to 15 years.....	1390	437	31.4
Adults.....	4931	1139	23.0
Totals.....	9650	2541	26.3

This table shows definitely that the average percentage of latent infection varies but little in adults or children, and that it is just as important to determine the percentage of such infections in the adult population as in the children if one desires to ascertain the exact malarial index in any locality.

A very large percentage of latent malarial cases are "carriers" of the infection, and it is therefore evident that the discovery and treatment of these cases is of the greatest prophylactic importance. I believe, from my own experience, that at least 50 per cent. of latent malarial cases are carriers of the infection, and when one remembers the large percentage of latent infections in every malarial region it is evident what an important part such individuals play in keeping up the malarial index of such regions.

The discovery of these latent infections depends upon the examination of the blood of both children and adults in infected localities, and it is evident that such examinations should be made by trained physicians, preferably by local or State Board of Health Laboratories. Municipal and State Boards of Health should provide for the free examination of blood, so that physicians who are unable to make such examinations can have them made promptly and easily. If physicians in malarial regions would insist upon a blood examination in every patient coming to them a large number of latent infections would be discovered and properly treated.

After these latent infections are discovered the treatment given will vary according to whether they are *gamete* carriers or are only harboring the forms found in the human life-cycle of the plasmodia. If the latter be the case the treatment will be the same as recommended for the treatment of *initial* attacks, hereafter to be given, but if *gametes* are present a different line of treatment must be adopted.

Unfortunately, in a very large percentage of latent infections the persons affected are found to be harboring the *gametes* or forms intended for development in the mosquito, and it is especially important that these cases be properly treated. It is known that the *gametes* are much more resistant to quinine than the forms found in the human life-cycle of the plasmodia, but Darling and Thomas have both shown that they can be reduced to a non-infectious ratio by the proper administration of the drug. In a large series of experiments at Panama, Darling has shown that the administration of thirty grains

(2 Gm.) of quinine daily for two or three weeks will reduce the *gametes* to a non-infectious number, and this treatment should be given every *gamete* carrier if practicable. In regions where it is impossible to get rid of mosquitoes it will also be found impossible to get rid of malarial infection unless the "carriers" of the infection be discovered and treated.

It has been shown that large doses of quinine are required to render *gamete* carriers harmless, so large that in very many instances the individual concerned refuses to be so treated, and it follows that a still more valuable prophylactic measure is the prevention of *gamete* carriers. In other words, proper treatment of the initial infection in every "carrier" would have prevented the formation of *gametes*, and there would have been no "carrier." In the prophylaxis of malaria the vast importance of the proper treatment of initial infections has not been realized by the profession, and it is sad, but true, that a very large proportion of the malaria present in every locality is directly due to improper treatment of initial malarial infections. While, in many instances, *gametes* may have developed before the onset of definite symptoms, in the vast majority of cases they do not appear until after symptoms have been noted and treated, and if treated properly the *gametes* may be prevented from developing. The practice of regarding a malarial infection as cured because the symptoms have disappeared is responsible for most recurrences and for the development of "malarial carriers." Nothing is more common than to see malarial patients returning to their work after only a day or two of treatment, inquiry eliciting the fact that the attending physician has given no directions regarding the necessity of continuing quinine for weeks and even months, if a recurrence is to be prevented. The profession has apparently not been impressed with the fact that every malarial infection is resistant to treatment; that the mere disappearance of the symptoms is no proof that all the plasmodia are destroyed; and that a continued course of quinine is absolutely necessary to eradicate even the mildest malarial infection. The attitude in this respect is very similar to that which obtained in regard to the cure of syphilis before the days of the Wassermann test. In both malaria and syphilis specific drugs were supposed to exist, and if, after the use of these drugs, the symptoms disappeared, the patient was regarded as cured. In the case of syphilis, however, it

was recognized that from two to three years of treatment was necessary before this supposed cure was accomplished, even in the absence of symptoms; but in the case of malaria a large portion of the profession appear to believe that a few doses of quinine, if followed by the disappearance of symptoms, signifies the cure of the infection.

It is therefore essential that every malarial infection, especially the initial infections, be properly treated; for it is doubtful if there is a more important prophylactic measure known to the sanitarian than the prevention of carriers of disease, and unless patients suffering from this disease be so treated our other prophylactic measures may prove futile. As the treatment of both latent and initial malarial infection is covered in that portion of this communication devoted to treatment, it will not be considered at this time.

EDUCATION OF THE PUBLIC

For the success of any method of prophylaxis against malaria it is absolutely essential that the sanitarian have the cordial and earnest support of the public. This cannot be obtained unless the public thoroughly understands the necessity for, and the reasons underlying, the prophylactic measures depended upon for its eradication. It therefore becomes the duty of the medical profession so to present this subject that the public will not only desire, but will insist, that proper measures be instituted for the prevention of malaria in all regions where the disease is endemic. It is useless to ask for funds for the prosecution of extensive campaigns against malaria until the public is awakened to the vast economic importance of this disease in the prosperity of the section which we desire to rid of the infection, and this knowledge can only be given the public by the efforts of the medical profession.

To this end the press of the locality should be interested and made use of to the greatest extent possible; illustrated lectures should be given by qualified men, showing the relation of the mosquito to malaria, the proven means of preventing the disease, and the financial benefit following such prevention; the Boards of Health of the infected region should issue bulletins giving in simple language the facts covering malarial prophylaxis, and should encourage the people

to ask for examinations of the blood without consulting the physician; while members of the profession should take every opportunity to give their patients instruction in the essentials of malarial prophylaxis. In addition, the facts underlying the prevention of malarial infection should be taught in the public schools of every infected district, for if these facts are impressed upon the minds of the children they will not be forgotten, and it will be only a question of time before measures based upon them will be put in operation. As I have said elsewhere: "The young are receptive, and there is no better way of interesting the parents than by the instruction of the children. Not only is this true, but what one learns in youth becomes a matter of habit, and will be practised throughout life. The adage 'You cannot teach an old dog new tricks' is often exemplified when attempts are made to instruct the adult population in modern views of the etiology and prophylaxis of disease, and for this reason it is most important that the youth be thoroughly taught regarding the prophylaxis of malaria."

Notification of cases of malaria should be made obligatory, just as is the notification of other infectious diseases. This measure alone would impress the public with the importance of these infections, and lead to the conviction that these fevers are really infectious and a serious menace to the health and prosperity of the community.

In our own country the creation of a national commission for the study and prevention of malaria would be a great step in advance, and would be of inestimable benefit in the prophylaxis of the disease. Such a commission could investigate the fevers prevalent in so-called malarious regions with a view to determining the proportion actually due to malarial infection, and the methods of prophylaxis which could be most economically and successfully employed in the endemic districts. A survey of the entire malarial country could thus be secured, and intelligent effort be made to eradicate the disease. The commission should be composed of experts upon the subject, and should include an expert sanitary engineer. At the present time the greatest confusion exists regarding the nature of the prevalent fevers of many localities in the United States, and such a commission would be of the greatest service in solving this problem as well as in mapping out a campaign against malaria.

SOME RESULTS OBTAINED IN MALARIAL PROPHYLAXIS

In concluding this portion of our subject it may not be amiss briefly to note some of the results attained in the prophylaxis of malarial fevers in various parts of the world. One of the most striking examples of the benefits following the destruction of the breeding places of mosquitoes is furnished by the work of Watson and Travers, at Klang and Port Swettenham, in the Federated Malay States. In 1901 over 600 cases of malaria occurred in these small towns, and in 1902 mosquito work was commenced. In 1905 only 23 cases of malaria were reported in these towns, and at the present time the disease has entirely disappeared.

The results achieved by Colonels Gorgas and Kean, of the Medical Department of the United States Army, in ridding Havana of both yellow fever and malaria, is another striking example of the efficacy of mosquito destruction. In 1900 the number of cases of malaria reported in Havana was 325. Mosquito work was begun in February, 1901, and the yearly number of cases from that time until 1910 was as follows: 1901, 151; 1902, 87; 1903, 51; 1904, 44; 1905, 32; 1906, 26; 1907, 23; 1908, 19; 1909 (to July), 2.

The work of the Society for the Study of Malaria in Italy has resulted in a very great decrease in the morbidity and mortality from the disease in that country. According to Celli, malaria has been decreasing in Italy ever since the law went into effect regarding the issue of quinine by the State, the mortality of the disease having diminished over 75 per cent., and the morbidity in proportion. Celli claims that the issue of quinine in 1905 saved no less than 7500 lives, and that of 59,340 persons taking daily doses of four centigrammes, only 5.8 per cent. developed malaria, including both initial and recurrent infections. While in Italy all measures of prophylaxis have been used to some extent, Celli regards the prophylactic use of quinine as altogether the most efficient, and states that it is the only method that can be depended upon to control malaria in Italy. The screening of habitations alone has markedly reduced the number of cases of malaria in many localities where this measure has been carefully carried out. Thus, Procaccinna, in Sardinia, reduced the number of cases among military troops from 70 to 57 per cent. in one season by screening their barracks, and later the percentage was reduced to less

than 20. Tzuzuki, in Formosa, protected 115 soldiers by screening their barracks during the malarial season and confining the men in the barracks after sundown, and not a single case of malaria developed. On the other hand, during the same period of time 251 cases of malaria occurred among 717 soldiers that were not protected in this manner (Fig. 8).

The combination of measures for mosquito destruction and quinine prophylaxis met with wonderful success at Ismailia, a town of 6000

FIG. 8.

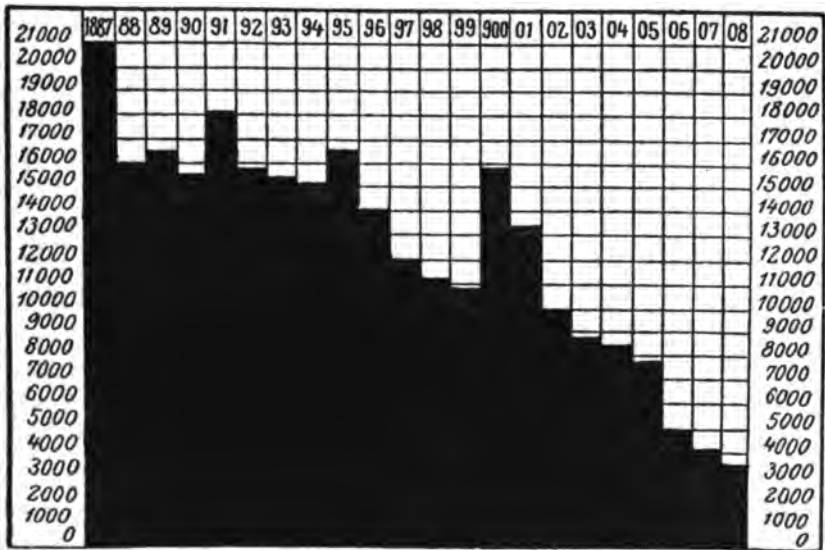


Chart showing the decrease of deaths from malarial fever in Italy. (After Celli.)

inhabitants upon the Suez Canal. In 1900 there were over 2000 cases of malaria in this town, and in 1902 prophylactic measures were first introduced. In 1906 Ismailia was declared free from malarial infection. Pressat, who had charge of malarial prophylaxis, states that the greater part of the work in the destruction of mosquitoes was accomplished by a mosquito brigade composed of only four men.

It is unnecessary to speak of the brilliant results in the prophylaxis of yellow fever and malaria achieved upon the Isthmus of Panama by Colonel Gorgas and his coworkers. These results are known to all, and so long as history is written will be pointed to as one

of the greatest victories won by preventive medicine over infectious disease. In 1905 the number of cases of malaria admitted to the hospitals during the year was practically 7 per cent. of the working force; but in 1912, although the force had been very greatly increased, the cases of malaria admitted to hospital were but 0.92 per cent. of the working force, while there has not been a case of yellow fever in the Canal Zone since May, 1906. The death rate from malaria has been reduced from 16.21 per thousand in 1906 to 2.58 per thousand in 1909, while the admission rate has been reduced as stated (Fig. 9).

FIG. 9.

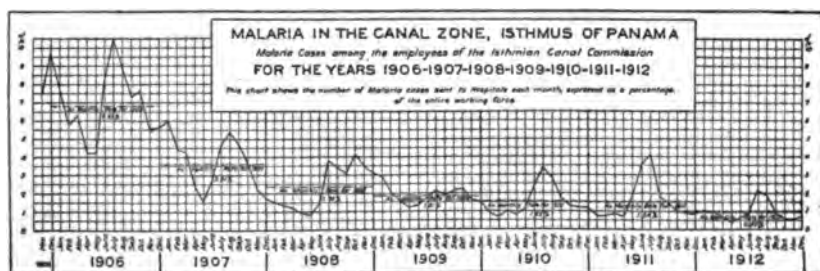


Chart showing the decrease in malaria in the Canal Zone. (From Sanitary Report of the Board of Health of the Canal Zone, 1913.)

These illustrations of the excellent results following intelligently-applied measures for the prophylaxis of malaria might be multiplied almost indefinitely, but they serve to show that malarial infections are preventable, and that their presence in any number in any locality is a reflection upon the knowledge of sanitation and the public spirit of the citizens of that locality. As Celli has well said, malaria is a purely economic question, and the disease can be eradicated just as soon as the public insists upon the prosecution of proper prophylactic measures.

THE TREATMENT OF MALARIAL INFECTIONS

Despite the fact that it has been known for centuries that cinchona and its alkaloids are specifics against malarial infection, killing the malarial plasmodia when brought in contact with them, the fact remains that perhaps no drug is more abused than is quinine, or used

in a more unscientific manner by so great a mass of the medical profession. Almost every physician has his own method of treating malaria, and too often this method consists simply in giving enough quinine to control the symptoms without reference to actually curing the infection. I have already spoken of the immense importance in the prophylaxis of the disease of *curing* malarial infections, and, at the risk of repetition, shall allude again to this phase of our subject in the treatment of the disease.

The subject of the treatment of malarial infection may be most easily considered under the following headings:

1. Effect of quinine upon the malarial plasmodia.
2. Choice of preparation.
3. Time of administration and dosage.
4. Methods of administration.
5. Contra-indications to the use of quinine.
6. Substitutes for quinine.
7. General treatment and treatment of special symptoms.

1. *Action of Quinine upon the Malarial Plasmodia.*—Quinine is a specific for malarial infections because it destroys the plasmodia. The action of this drug upon the parasites has been studied by many observers, and may be summed up as follows: Quinine affects the plasmodia at every stage of their development up to the presporulating stage and the full development of the *gamete*. It is most effective upon the *merozoites* just at the time of sporulation and before they have entered the erythrocyte, but even after this has occurred I have shown that the drug acts upon them, delaying the development of the *schizont*, and producing atypical sporulating forms, the number of spores being reduced, and many of those produced being sterile, as shown by the absence of the chromatin of the nucleus.

While we have no experimental evidence to support the assumption, there is very good reason to believe that the prolonged administration of quinine in doses insufficient to kill the plasmodia results in the development of quinine-fast strains of plasmodia, and that these strains explain those instances of great resistance to the drug and also the occurrence of relapses in many cases of malaria that have been treated vigorously with quinine.

2. *Choice of Preparation.*—Many salts of quinine have been used in the treatment of malaria, but, in my opinion, the only ones really

of great service are the sulphate, the dihydrochloride, and the tannate. The sulphate is the salt most used by mouth, and, while it is more irritating to the stomach than some of the others, this is more than counterbalanced by its cheapness and efficiency. For general use the sulphate of quinine fulfils all requirements, and has given the greatest satisfaction in the treatment of malarial infection.

The dihydrochloride, because of its solubility (1 part to 0.96 part of water), I have found to be the best salt for hypodermatic use, while the tannate is especially useful in malarial prophylaxis. Celli states that this salt is ideal for use as a prophylactic, as it is almost tasteless, well tolerated by the stomach, is absorbed more slowly, and is more completely oxidized than any other of the salts of quinine.

3. *Time of Administration and Dosage.*—It has been shown that quinine will act upon nearly every stage in the asexual life-cycle of the malarial plasmodia, being most effective upon the *merozoites* or spores and the young intracellular forms of the parasites. It is evident, therefore, that the best results will be obtained in the treatment of malaria if the drug is continually present in the blood, and this is best secured by giving the quinine in divided doses at regular intervals throughout the twenty-four hours. Not only will better results be attained by administering the drug in this manner, but the discomfort to the patient is less than when quinine is given in one very large dose. In acute attacks the drug should be given in appropriate doses every three or four hours until the symptoms have disappeared, and then continued as recommended in the next section of this paper.

The *dosage* of quinine necessary for the cure of a malarial infection must vary with the severity of the infection, the resistance of the plasmodia to the drug, and the species of plasmodium concerned. The chief fault that I have observed in the administration of this drug is the use of too large a dose, given for a short time or only until the symptoms have disappeared. I have very frequently seen patients given as high as five to six grammes (75 to 90 grains) in twenty-four hours; such large doses are never necessary, and simply increase the discomfort of the patient, and, in some instances, even do harm. I have never found it necessary to administer more than 2.5 grammes (gr. xl) during the twenty-four hours, and generally the administration of two grammes (gr. xxx) during this time will be amply sufficient, if continued as recommended below.

While I do not believe in any routine method of treatment of malaria, because the cases vary so much in severity, I have found that the following scheme of treating infections with the various species of plasmodia has given good results in the vast majority of cases.

Tertian and Quartan Malaria.—In these infections, during the acute symptoms, quinine should be given in doses of 0.32 Gm. (gr. v) every four hours until from one to two grammes of quinine (gr. xv to xxx) are given in the twenty-four hours, and this dosage continued until the symptoms have disappeared. Thereafter the drug should be continued for at least three months, the dosage being gradually reduced during the first two weeks of convalescence until the patient takes 0.32 Gm. (gr. v) per day at the end of the second week, and this dose should be continued for at least two weeks longer. It is then well to give the same dose twice every week until three months have elapsed from the date of the attack.

Æstivo-autumnal Malaria.—In æstivo-autumnal malaria the dosage of quinine must be somewhat increased, as these infections are more resistant to treatment than either the tertian or quartan infections. If pernicious symptoms arise, quinine should be injected intravenously, but in other cases it is best given by the mouth in solution or capsules. In most cases a dose of 0.32 Gm. (gr. v) administered every four hours will dispel the symptoms within three or four days, but in some cases larger doses will be required. After the symptoms have disappeared the drug should be continued in doses of one gramme (gr. xv) every other night on retiring for at least a week, and for two months thereafter this dose should be administered every seventh night.

In order to cure our cases of malaria it is absolutely essential that some such continued method of administration of quinine be used; otherwise relapses are almost sure to occur, and the patients become carriers of malarial infection. Every physician should see to it that his malarial patients are warned of the necessity of keeping up their quinine if they desire to avoid relapses. I am fully aware of the fact that the time of administration and dosage of quinine advocated here will not prevent relapses in all infections, but from experience I am convinced that it will in most instances, and I know that we will be fortunate, indeed, if the majority of our patients can be induced to follow out even this comparatively easy mode of treatment.

The treatment of *latent malaria* and of *relapses* is that of the acute infection until the plasmodia have disappeared, then a course of quinine for two or three months as already recommended.

If *gametes* are present the patient should be treated with large doses of quinine, from 1.5 to 2 grammes (gr. xx to xxx), every day for three or four weeks. According to Thomson, this will cause the disappearance of the *gametes*, or at least will reduce them to a non-infectious ratio. It should be remembered, however, that the proper treatment of initial infections will prevent the development of *gametes* and the infection of mosquitoes from the *gamete* carriers.

The dosage of quinine suitable for *hypodermic administration* will be discussed in the next section of this paper.

In *children* the dosage of quinine should be proportionate to the age of the patient. Under one year of age 0.032 Gm. to 0.065 Gm. (gr. ss to i) may be given and repeated as in the adult. In older children proportionately larger doses can be given, as children bear the drug well. Perhaps a good rule is "one grain (0.065 Gm.) of quinine for each year of age until 10 years, then two grains for each year." In pernicious cases, even in young children, one should not hesitate to use proportionately larger doses. Confections of the tannate of quinine with chocolate are very convenient for young children, as the taste is so disguised as to be practically absent.

4. *Methods of Administration.*—The following methods of administration of quinine have been recommended in the treatment of malarial infections: By the mouth, by the rectum, subcutaneously, intramuscularly, and intravenously. The method usually employed is the administration of the drug *by the mouth*, and in the vast majority of our cases of malaria this method fulfils all requirements. When given in this way quinine may be administered in the form of a solution, pills, tablets, capsules, wafers, troches, and confections. Pills should never be used if other preparations are available, as they are apt to be insoluble, and the same objection applies to tablets. The drug is best given in solution, the sulphate being dissolved in water with one drop of dilute hydrochloric acid added for each grain of the drug. While many patients object to the solution because of its bitter taste, it should be used whenever possible. Capsules and wafers are good forms, but have the objection that the drug is liberated *en masse* in the stomach, and often produces nausea or other

disagreeable symptoms. In children the tannate of quinine mixed with chocolate or given in the form of a confection is the best preparation to use by the mouth.

The administration of quinine *by the rectum* is here mentioned only to be condemned. When the drug cannot be given by the mouth it is much better to give it intramuscularly or intravenously than by the rectum. I cannot see that this method of administration has any place in the treatment of malaria.

The *subcutaneous administration of quinine* I believe should be abandoned. It is painful, often results in abscess formation even when great care is exercised to prevent infection, and absorption is slower than by the stomach and less complete. I have never found this method essential in the treatment of malaria, and the same remark applies to the *intramuscular administration* of the drug. Abscesses are less apt to follow intramuscular injections, but the treatment is painful, a coagulum results, and a large part of the drug injected becomes useless.

In those rare instances in which quinine cannot be taken by the mouth and it is not desirable to give it intravenously, intramuscular injection is indicated. The salt used should be one readily soluble in water, and I prefer the dihydrochloride for this purpose. The following is the solution employed:

R Quinine dihydrochloride 5 Gm. (gr. lxxv)
 Normal salt solution 10 Gm. (3iiss)

In this solution 1 Cc. contains 0.5 Gm. (gr. viiss) of the drug. The syringe used for the injection should be sterilized, the skin over the muscle to be injected washed with soap and water and painted with tincture of iodine, and the injection made deep into the muscle. The quinine should be dissolved in a small amount of absolute alcohol, which practically sterilizes it, and should then be placed in the salt solution, which should be made from freshly-distilled water. Every precaution should be taken to preserve strict asepsis.

The *intravenous administration of quinine*, first introduced by Baccelli, is the method of choice in any case when pernicious symptoms of malaria appear, or whenever it is desirable to secure the most prompt action of the drug. I believe that the time will come when the intravenous administration of quinine will be the routine method

of treating malarial infection, as it is surely the most logical one, but at the present time this mode is generally reserved for pernicious cases of the infection.

Bacelli recommended the use of a solution of quinine containing one gramme of the dihydrochloride in 10 Cc. of salt solution, the entire amount being injected into a vein. While thousands of cases have been thus treated without bad results, a few deaths have occurred that have been ascribed to the great concentration of the drug, and it has therefore been recommended that a greater dilution be used when quinine is employed in this manner. The following formula will be found satisfactory:

℞ Quinine dihydrochloride	1 Gm. (gr. xv)
Normal salt solution	150 Gm. (℥ivss)

The salt solution used should be made with freshly-distilled water and be luke-warm when injected. The quinine employed should be dissolved in a small amount of absolute alcohol before it is added to the salt solution, and it is always well to give a hypodermic of whiskey, ether, or strychnine just before the injection. It is unnecessary to add that the most careful precautions should be used to maintain asepsis in every stage of the operation.

The most simple method of injecting the solution into the vein consists in placing the solution in a suitable sterilized glass vessel having a connection at the bottom for a rubber tube which should contain a glass window; the needle is attached to the end of the tube and the flow of the fluid controlled by a stop-cock. A small plug of sterilized absorbent cotton should be placed at the bottom of the vessel containing the quinine solution to act as a filter. The skin over the vein should be washed in hot water and painted with iodine, then a little fluid is allowed to flow through the needle, the needle is inserted directly into the vein, and the solution allowed to flow into the vein. After the fluid has almost entirely disappeared from the containing vessel, the needle should be withdrawn, the site of the puncture painted with iodine, and a collodion dressing applied.

5. *Contra-indications to the Use of Quinine.*—In very rare instances patients are observed in whom quinine produces, even in small doses, alarming and even very dangerous symptoms. Fortunately, such instances are uncommon, or the treatment of malaria would be

much more difficult than it is at present. In these patients some substitute for the drug must be employed, as it is often more dangerous to persist in the use of quinine than to allow the malarial infection to go untreated or poorly treated. Where there is a history of dangerous symptoms following the use of quinine, the drug should be given only in small doses until one is sure that the history is correct, and, if so, it should be discontinued.

Pregnancy is not a contra-indication to the use of quinine. I have frequently given it in this condition and have never yet observed a case of abortion produced by the drug, although I have seen abortion produced by an untreated malarial infection. In pernicious cases among pregnant women quinine should be administered intravenously just as in other pernicious infections. While the use of the drug in this manner may cause abortion in some cases, it is, I believe, justifiable to disregard the life of the child when the mother's life is endangered.

6. *Substitutes for Quinine.*—A number of substitutes for quinine have been advocated from time to time, but it may be truthfully stated that none of them is as efficient as the drug itself. The most important of these are methylene blue, phenocoll, and euchinin.

Methylene blue is efficient in mild tertian and quartan infections, but the drug must be given for a long time and is not devoid of danger, as it may produce strangury, albuminuria, and severe diarrhoea. It is given in doses varying from 0.15 to 0.2 Gm. (gr. ii to iii), repeated every four hours, in capsules with a little powdered nutmeg.

Phenocoll has some effect upon tertian and quartan infections, but is a heart depressant and in many cases must be given cautiously. The dose is from 1 to 3 Gm. (gr. xv to xlv) distributed over the twenty-four hours.

Euchinin is a salt of quinine, and, while less irritating than other salts, is less efficient and is often poorly borne by those who cannot take the ordinary salts of the drug.

Salvarsan and neosalvarsan have some effect upon tertian and quartan malarial infections, but are useless in æstivo-autumnal infections.

7. *General Treatment and Treatment of Special Conditions.*—All patients suffering from malarial infection and showing acute symp-

toms should be placed in bed and the bowels thoroughly evacuated. Any special symptoms, as delirium, failure of the heart action, collapse, excessive fever, or intense nervousness, should be given appropriate treatment as in other infections. Aside from the administration of quinine for curative effect, much may be done to render the malarial patient comfortable by recognizing and treating the symptoms as they arise.

The treatment of malarial cachexia consists largely in removal to a non-malarious region and the use of quinine and tonics. Chronic malarial infection I am unable to understand,—if proper treatment has been given the patient during the initial attack of the disease,—and the occurrence of such cases always signifies improper treatment at the hands of the attending physician, except in those rare instances in which it has been impossible to administer quinine.

In conclusion I would again urge upon the profession the absolute necessity of a prolonged course of quinine in every malarial infection if one expects to cure the disease and prevent its transmission to others. I am fully convinced that quinine, properly administered, will effect a cure in the vast majority of cases, and I am just as certain that the improper administration of this drug is the greatest cause of relapses and the production of “malarial carriers.”

REMARKS ON A CLINICAL STUDY OF UNCINARIASIS AND ITS TREATMENT

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THE natural resources of Porto Rico are indicated by its name,—a name given to it many years ago. Nevertheless, to all who were acquainted ten years ago with the actual conditions of the island from personal experience therein—however rich the soil, and however great the opportunities for turning that soil to account in producing high-grade crops, such as sugar, coffee, and tobacco—the anæmia and poverty of the working classes were a by-word. That this anæmia did not exist when the island was first settled, and the aborigines formed its main population, is chronicled by Christopher Columbus, who distinctly states that they were “a people of very beautiful appearance.”

Uncinariasis was undoubtedly introduced by the negro slave, who brought with him the species we now know as “*Necator Americanus*.” The disease did not become very evident until the cultivation of coffee was begun in the mountains, and its real appearance seems to have been about 1760. From that time on some itinerant writers have been pleased to describe the people of Porto Rico as lazy, lacking in initiative, etc. As a matter of fact, however, the healthy Porto Rican is of a lively disposition and very active, and simon-pure laziness is foreign to his nature, however much by racial tendency he may be addicted to the simple diversions and light-heartedness of other Latin peoples, who, like the French, do not come under our criticism.

Let it be understood that uncinariasis is a disease caused by the invasion of the body of man by an animal parasite, whose final resting place is the intestine; that each person who harbors this parasite discharges with the fæces millions of microscopic eggs which develop, under conditions of tropical temperature, moisture, and shade, into tiny larvæ; and that these larvæ, when the damp earth

Fig. 1.



The mountains at Utundo covered with coffee plantations.

FIG. 2.



A coffee bush loaded with beans. Note the shade tree whose trunk is the chief part visible. In the shade of these bushes earth-soiling is common.

upon which they lie is handled or stepped upon, penetrate through the healthy skin, entering by the ducts of the sebaceous gland, and passing into the lymph-spaces; from this point they proceed to their destination in the intestine, or wander about in the lymph-spaces for an indefinite time, possibly producing ulcers, difficult of healing, at or near the point at which they effect an entrance.

In the intestine they reach a size of from one-half to three-fourths of an inch, the males being the smaller and in the minority. Thus, hanging from the intestinal lumen like stalactites, they feed chiefly upon the lining membrane of the mucosa, their powerful jaws grasping a fold of mucous membrane to insure their hold. Of course, buried in so vascular an organ as is the intestine, feeding upon its lining membrane, and shifting their position from time to time, it is natural that there should be some bleeding, and not only does the worm swallow some blood-corpuscles along with its principal food, but it wounds small vessels which bleed considerably, especially when movement is most active, which is supposed to be at the time of copulation. This bleeding has been explained by the statement that the worm is essentially a blood-sucker, and thus produces the characteristic anæmia; but we have repeatedly proved that some of our severest cases were produced by very few worms, and that, on the contrary, many cases containing more than 1500 showed very little, if any, anæmia. Moreover, there seems to be a racial immunity to the effects of uncinarial invasion. This is relative, it is true, but it is quite distinct, and if bleeding were really the cause of the anæmia this fact would be difficult to explain. The negro race is distinctly less susceptible to the effects of invasion than the white. There are many other reasons for believing that the anæmia of uncinariasis is not that from mere loss of blood, as will be seen later.

When one considers that Porto Rico has a pretty equally-distributed population of about 300 persons to the square mile, and that in the mountains—where two-thirds of these live as poor laborers—earth soiling is practically universal; that these people for the most part cultivate coffee under shade in an island where the rainfall is so abundant as to keep these plantations constantly wet,—one sees that ideal conditions are offered for an intensive infection, and one clearly understands how it is that after a series of multiple invasions,

each adding its "little bit to make a little bit more," the majority of the people harbor such a great number of these parasites as to produce, sooner or later, the severer forms of the disease.

The Porto Rico Anæmia Commission—of which I was a member—took the pains patiently to count all uncinariæ expelled throughout the course of seventy cases, treated weekly by specific remedies, until all the eggs disappeared from the fæces, and an average was found of over 1000 uncinariæ harbored per individual. This was the state of affairs which yielded a death rate of over *30 per cent. of the total deaths* on the island at the time we took up our work. It was the cause of the partial or complete invaliding of at least *70 per cent.* of the laboring classes of Porto Rico, and it caused a reduction in efficiency for labor of not less than *50 per cent.*

Of the 4741 persons who were questioned in the 1904 campaign as to whether or not they had had ground-itch (*mazamorra*), the typical initial dermatitis, generally from contact of the bare feet with infected mud, *98+ per cent.* replied in the affirmative. The localities where we may expect to get the most potent infections are reflected in the answer of 18,865 persons, of whom *65+ per cent.* named the coffee plantation, and most of the remainder the roads, habitations, and streams thereon. Thus we see that the vast majority of the severer cases of anæmia came from the very places where, in conformity with the life-history of the parasite, we might expect to find the most abundant production of larvæ from eggs deposited in the soil,—for coffee is grown in dampness under shade. Coffee-workers almost universally go barefooted, and respond to the calls of nature in the groves where they work or in the surroundings of their modest huts. Within the coffee plantation itself little pools of water, polluted by decaying banana leaves, are the spots most dreaded by the laborer, on account of the ground-itch they are almost sure to produce. Our experience with the dry, sandy, and alluvial littoral, generally devoted to the raising of sugar-cane and fruits, is that such regions do not seem to favor heavy infections, and that the people are much more free from the severer forms. So true is this that there is an expression in Spanish to the effect that the "*el palido*," or anæmic, is a mountain-dweller.

Both sexes are infected, practically alike, for women go barefooted as well as men, and when they do not get the disease from

the groves they get it from the surroundings of their homes. While persons of all ages are liable to infection, the liability does not depend upon the age, but upon the opportunities for infection,—or, in other words, the sum total of the bare-footed life they lead. It is a melancholy fact, however, that 72 per cent. of 18,865 cases were under 30, and that most were found to be between 15 and 40 years of age,—the most active period of a laborer's life.

Uncinariasis begins, in practically every case here, as a dermatitis, generally of the feet,—the so-called “mazamorra.” This dermatitis—usually between the toes—comes on rapidly, in a few hours after exposure. The feet swell, are red, and present papules which become vesicles, and, if concurrent infection by pyogenic organisms has occurred, these vesicles fill with pus. Beginning with tingling and prickling, the feet may become so swollen and painful as to incapacitate the patient for all work. In a large number of cases of repeated infections we see individuals with large, indolent ulcers on the lower third of the leg which are not syphilitic, and can best be explained by the continued presence of wandering larvæ in the subcutaneous tissues, with subsequent secondary infection by pyogenic organisms. Some authors describe a preanæmic and prodromal urticaria, furunculosis, or general pruritis without eruption, and a peculiar catarrhal bronchitis which occurs about the same time. While we have seen these phenomena in some of our cases, they have been somewhat unusual, and cannot be considered distinctive of uncinariasis.

THE ONSET OF THE DISEASE

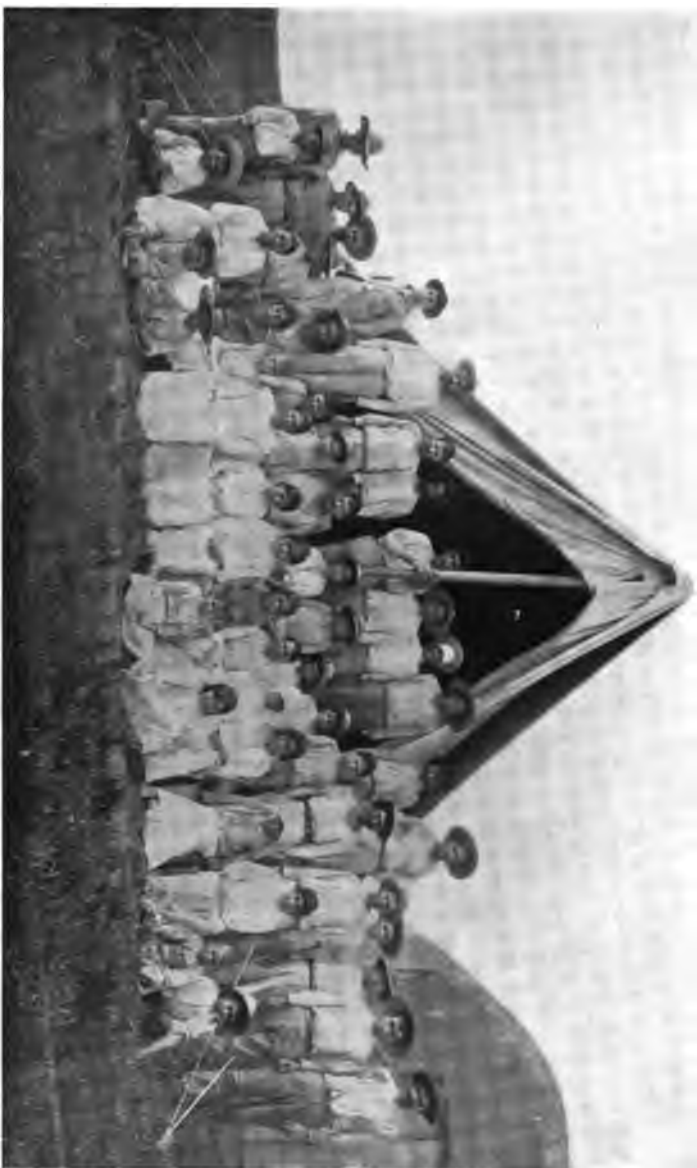
Uncinariasis is most insidious in its onset, and “feeling out of sorts” with vague dyspeptic symptoms is about all we can elicit. Such people are constantly weary and listless. The more abrupt, acute forms, with melæna, vomiting, and violent pains, are rare. For convenience we have divided the grades of the disease into three: *Light*, *moderate*, and *marked*. Of a series of 287,568 cases, 4 per cent. were very light, 20 per cent. light, 45 per cent. moderate, 25 per cent. marked, and the rest, except 1 per cent. not classified, very marked.

Light Cases.—These show little or no pallor; at most a sallowness. This is the grade in which we find the patient complaining of

dyspepsia and weariness alone—for the other systems are not yet sufficiently involved, as a rule, seriously to attract his attention. The appetite is usually voracious, and constipation the rule. Closer questioning will often reveal, however, some overaction of the heart, slight breathlessness after exertion, and a little dizziness. The hæmoglobin of such persons lies between 60 per cent. and normal. Eosinophilia is a frequent and early indication of infection. There is, however, a distinct reduction in mental activity, a distaste for work, and apparent laziness; indifference, abstraction, and a tendency to forget are manifest. The facial expression bears out the conditions mentioned. In short, the individual—previously vigorous and energetic—gradually finds himself losing in strength and inclination to work, with an indefinable dyspepsia and a faint pallor. To his friends he is “run down”; to those who do not know him he is “lazy and lacking in initiative.”

Moderate Cases.—All the symptoms of a light case are more pronounced: the skin is quite dry, sweating is rare; vague pains are felt in the chest and knees, and the following signs and symptoms make their appearance: intestinal fermentation, frequently some cardiac hypertrophy, more rapid pulse, palpitation of the heart, much dizziness, frequent headaches, noises in the ears (*tinnitus aurium*), and distinct anæmia of the secondary type, with the hæmoglobin from 30 to 60 per cent., *erythrocytes* around 4,000,000 per cubic millimetre, and an *eosinophilia* which at this period of the disease is apt to reach its high-water mark. The mental picture of the patient is the most vivid one, at least to his friends: he is melancholy, apathetic to all of his surroundings, and has become apparently very stupid or confused. The *patellar reflex* is generally diminished, and there is pallor, paræsthesias of the feet are common, and partial impotence in men and amenorrhœa in women are noted. Delicate tests may reveal albumin and casts in the urine. As a rule, there is no emaciation, but the muscles are soft, and work is distinctly an effort. In short, the patient is suffering from a moderate case of uncinariasis, and looks and feels sick. He is not only disinclined to work, but more or less unable to do so. There is a distinct anæmia, and the circulatory system has begun to protect. The subject can be described as a moderately anæmic individual, with minus activity of mind and body.

FIG. 3.



Group of patients suffering from uncinariasis (From U. S. Senate Document, No. 808.)

FIG. 4.



Group of patients, field hospital, Utuado.

FIG. 5



Field hospital for treatment of selected cases of uncinariasis, Utuado.

Marked Cases.—This is the type in which a fatal termination may occur at any time. Anæmia is extreme; there is œdema of the feet, and even anasarca. Diarrhœa may alternate with constipation, but intestinal fermentation with overproduction of gas is the rule. In many cases appetite is well-nigh extinguished. The hypertrophied heart tends now to dilate, or to reach such a point of weakness from fatty degeneration of the muscle as to threaten life. The urine is not notably affected; it is abundant in quantity, of low specific gravity, and often contains albumin, usually only a trace, with casts. Here, as in the other two grades of the disease, the nervous system suffers most severely. Mild mental confusional states are the rule, but manic-depressive insanity may intervene. There are headache and insomnia, abolition of deep reflexes, paræsthesias, complete impotence, amenorrhœa, reduction of visual acuity, and even retinal hemorrhages. Such patients are apt to be always cold, even in a tropical country; the muscles are sore and painful, and have become very flabby; the patient is so weak that even a simulation of paralysis may be observed,—once confused with beriberi. In extreme cases irregular fever is not uncommon, although subnormal temperature is, of course, the rule. The hæmoglobin in marked cases generally runs below 30 per cent.; in very marked cases below 20 per cent. It is curious that whereas in marked cases the color index is apt to be low and the eosinophilia still evident, in the extremely severe cases—and especially in those likely to die in spite of treatment—the eosinophilia disappears, and the blood takes on most, if not all, of the characteristics of true pernicious anæmia.

Uncinariasis, therefore, is a disease caused by the invasion of a sufficient number of hook-worms to overcome the natural or racial immunity of man. Its manifestations depend upon: (1) the number of worms harbored; (2) the length of time they have lived in their host; (3) the susceptibility of the host to their hypothetic poison.

The effects of such infection are modified by: (1) concomitant disease, or constitutional weakness; (2) the involvement of organs, such as the heart, kidney, brain, blood, etc., to an extent which seriously disturbs function; (3) the ability of the patient from his position in life to resist the effects of the poison which is being elaborated within him. A relatively easy life, with plenty of food and absence of concomitant disease, promotes strong resistance. In

such individuals uncinariasis does not ordinarily manifest itself as in the bodies of the poor, forced to hard manual labor, without shoes, and with insufficient pay, coarse and indigestible food, and exposure—not only to the elements, but to continual reinfection from their places of work, which they and their associates are constantly replenishing with ova to hatch out into infective larvæ.

In commenting upon the manifestations of the disease noted above, there are a few points under each of the systems which need to be brought out rather strongly:

Cutaneous System.—In a clinical investigation we noted some persons as being very pallid, with a hæmoglobin of 70 per cent.; and others, showing little pallor, with hæmoglobins of 39, 42, 50, and 54 per cent. Atrophy of the skin is not at all uncommon, especially in the severer cases, and when seen in very anæmic children gives a pitiful expression to the face. As a rule, œdema is, of course, a late sign, but does not always depend upon the degree of anæmia and is rarely accompanied by albuminuria. Some truly extreme cases of anasarca have been seen,—cases in which the eyes could not be opened, the abdomen was enormous from ascites, and even the taking of the pulse left deep in the wrist the imprint of the physician's hand.

The Digestive System.—In a country where uncinariasis is frequent, all cases of what appears to be "dyspepsia" should receive a careful examination of the fæces. The well-to-do who are infected by uncinariasis present this, as a rule, as their chief, perhaps their only, evidence of the disease. Incidentally it should be remembered that such a person does not need to go barefooted to acquire uncinariasis. In a practice march into the country, and through coffee plantations, two of four companies of a battalion of the Porto Rico Regiment were unfortunate enough to pass through infested mud; they were well shod—with the army shoe and legging—and yet the muddy water, entering through the eyelets of the shoe and over its top, infected 50 men. So, overseers of plantations who wear shoes, and even the master or his well-dressed and carefully-educated daughter, may be similarly infected.

In considering the vagaries of the appetite, let us realize that what the patient wants, as a rule, is bulky food; something to fill him up, something to stop the constant gnawing. The natural result

is dilatation of the stomach,—a common phenomenon in uncinariasis. This craving for bulk brings about a perverted appetite, and earth-eating, feather-eating, raw-rice and raw-coffee eating, we see mentioned from time to time in descriptions of the disease.

Wherever *catarrhal stomatitis* occurs it should make us very suspicious of *sprue*, which seems to be getting more and more common in Porto Rico, and is not infrequently a terminal disease in the course of many others. In considering the appearance of the *faeces*, let us emphasize strongly the undeniable fact that blood in the stools macroscopically is very rarely seen. Of over 22,000 specimens examined by us in 1904 only six contained visible blood. Not only this, but, while frequently demonstrable by the most delicate chemical tests in infections by uncinariasis, it is utterly impossible to find traces of blood in some cases in which many worms exist. Dr. Pedro Gutierrez, Dr. José Janer, and myself made this a special study in a series of cases. In the examination of *faeces*, once the egg is known, very little difficulty exists in making a diagnosis,—for when we have to treat the disease, uncinariasis, the eggs are generally so abundant as to make anything more than a cursory examination of one specimen unnecessary.

The Circulatory System.—In considering the phenomena attached to the disturbance of this system we must remember the old French name given to uncinariasis,—“*mal de cœur*.” At first slight hypertrophy, then either simple degeneration of the heart muscles, of a fatty nature, as determined by our own microscopic sections, or this and true dilatation. *Arteriosclerosis* is not at all common. It is unnecessary to go over all of the usual phenomena dependent upon this condition of the heart, as they are perfectly well known, but we should emphasize the following symptoms: dizziness, tinnitus aurium, and syncope. These are almost universal in well-marked cases. An infrequent, but very striking, phenomenon is what appears to be a sudden *œdema* of the brain.

Respiratory and Genito-Urinary Systems.—As we have seen, the *respiratory system* exhibits nothing of special interest, nor does the urine, save that at times a degeneration of the kidney seems to occur, as well as actual nephritis. Traces of albumin and some casts are, however, very common.

The Blood.—When one pricks the ear of a distinctly anæmic in-

dividual two things are very noticeable: (1) The liquid which flows resembles "beef-washings" more than real blood; and (2) there is distinctly slow coagulation.

The Hæmoglobin.—In order to determine the average hæmoglobin percentage of the country people, readings were made of 579, consecutively and at random. They ranged from 9 per cent. to 101 per cent., but their average was only 43.09 per cent. This we believe to have been the average hæmoglobin of at least 70 per cent. of the people of the interior of Porto Rico when we began our work.

Of 281 very carefully studied cases, taken during a period of six or seven years, and in which the blood was systematically examined, 98 had 20 per cent. or less of hæmoglobin, average 15 per cent.; 70 cases lay between 21 and 30 per cent. hæmoglobin, average 25 per cent.; 91 lay between 31 and 60 per cent., average 40.07 per cent.; and 22 had between 61 and normal hæmoglobin, average 79.8 per cent. As the severer cases crept into this series, the average hæmoglobin was rather low, or 30.9 per cent. These 281 cases attained an average of 51.3 per cent. hæmoglobin after specific treatment, as a rule, for 58 days. Thirteen cases showed a hæmoglobin below 10 per cent., and one of but 4 per cent.

The examination of hæmoglobin and counting the eosinophiles give the real key to the condition of the patient. The fall in hæmoglobin percentage occurs before any noticeable diminution in the red cells. The average color index is 50 per cent. As a rule, the hæmoglobin percentage depends upon the number of parasites harbored; but this is only a very general rule, and the exceptions are striking and point to a circulating poison as the cause of the anæmia. For instance, in a series of 38 cases, in 10 of whom the hæmoglobin was 20 per cent. or less, the average number of worms harbored by the patient was found to be 1090; whereas in 16 cases whose hæmoglobin lay between 31 and 60 per cent. the average number of worms was 1224.

The Red Cells.—These averaged in our study cases, on admission, 2,406,422, with an average hæmoglobin of 24 per cent. In the severer forms practically every characteristic of pernicious anæmia could be found in these cells. The usual type, however, is an anæmia in which the red cells tend toward the chlorotic type; namely, microcytosis, with a low color index. A remarkably low red cell count

FIG. 6.



Group of country people in Utuado awaiting in line for the purpose of having their faces examined previous to treatment for uncinariasis.

was discovered in 1899; in this there were 697,776 red cells per cubic millimetre. There is a distinct lagging behind of hæmoglobin in the return of the blood to normal. In fact, under treatment the tendency is toward excess of microcytes and an excessively high total count. Counts above 7,500,000 with hæmoglobin still below 85 are not unusual, but the cells are very small.

The Eosinophiles.—These apparently increase at the expense of polymorphonuclear leucocytes and reach at times a very high figure. We had one case with 66 per cent. of eosinophiles. In general, moderate cases showed the highest eosinophilia. We have attempted to formulate our ideas concerning eosinophiles, as follows:

(1) Very severe chronic cases, with poor resisting power and exhausted blood-making organs; very little or no eosinophilia.

(2) A rise in eosinophiles is generally found in cases which progress favorably, and should influence the prognosis.

(3) If very severe cases, presenting little or no eosinophilia, fall in their eosinophile percentage without improving in their general condition, the prognosis for such cases is less favorable. In other words, good resistance to the poison of uncinariæ is expressed by eosinophilia.

The Nervous System.—The country laborer of Porto Rico afflicted with uncinariasis to any extent can truly be said to have a drowsy intellect; it is one of the most characteristic symptoms of uncinariasis. Indeed, this benumbing influence upon the mental faculties seems to be exerted before anæmia and circulatory changes can be demonstrated. The hypochondriacal, hopeless, and ambitionless expression, together with puffiness of the face and a peculiar color, we have not seen commonly in other anæmias. Many times the patient looks and acts as though he had been drugged, and questions have to be repeated over and over again before they penetrate into his mind. *Echolalia* is frequent, and the distinct effort made by the patient to concentrate his attention on what is being said to him is quite painful to witness. In the severest forms true dream-states occur; the patients have to be veritably awakened to elicit an answer. *Amnesia* is a most common mental condition. In bad cases there is real paralysis of thought, which makes them appear timid and uncertain, and seems to bear out a thoughtless criticism that they are lacking in character. While this describes the average or moderately

severe case, more deplorable states of mind than these are noted—even in the absence of marked anæmia.

The first and most important is the well-known “ataque,” or nervous attack,—really *hysteria major*. All “ataques” are not caused by uncinariasis, but the majority of the cases in the otherwise impassive “jibaro” are certainly due to this disease. They are best described by the term “hystero-epilepsy.” After the fit a period of logorrhœa succeeds, with more or less complete emotional unbalance. The “ataque” ends in a trance-like condition, the patient arousing with enough remembrance of what has happened to recount some of the events that passed. In other words, these attacks are apparently of the manic-depressive type, and are cured on treatment.

The General Development and Nutrition.—Wonderful examples of retarded development from uncinariasis are seen in Porto Rico. We ourselves have been completely deceived in our estimate of the true age of an individual, persons of twenty years seeming to be twelve or fifteen. Puberty is often delayed. In males the genital organs may be undeveloped and the hair of the body lacking. We have known cases where children have been born of mothers who said that they never menstruated. The bodies of uncinariasis patients are generally well developed, however, and nutrition is good. Thirteen male adults, averaging 66 inches in height, weighed on the average 129.2 pounds. Of course, later in the disease emaciation is liable to occur, but it is masked by anasarca.

Temperature.—At the outset of the disease fever is probably a fairly constant symptom, but in such well-developed cases as we saw the temperature is apt to be subnormal; usually fever is due to some complication.

TREATMENT

To expel *Necator americanus* there are only two drugs worthy of serious consideration: *thymol* and *betanaphthol*. Of these two *thymol* is infinitely superior,—for we have shown that *betanaphthol* is at times a serious irritant to the kidney, and apparently is less active in the expulsion of the worms. One or two million doses of *thymol* have been given in this country without fatality, the people taking the drug home with them, and at times undoubtedly taking rum afterward. It is getting to be a rather unpopular drug in this

island, however, as it sometimes causes considerable depression and a good deal of irritation of the bowel, dizziness, and burning in the stomach. The majority, though, have no symptoms of consequence from the drug. *Betanaphthol*, while it does not cause the burning and debility at times observed after the administration of *thymol*, does subtly (and sometimes very actively) affect the kidney. We have seen cases of violent nephritis set up by *betanaphthol*, unfortunately verified at autopsy. Nevertheless, its poisonous effect upon the kidney is rarely seen, and it may be administered to very weak patients and children in preference to *thymol*. The use of *eucalyptol* is absolutely unjustifiable; it is very dangerous, and well-nigh impossible to repeat, on account of the resistance of the patient, the chief symptoms being extreme debility, dizziness, dyspnoea and syncope. In our short experience with the drug it was generally necessary to administer stimulants to prevent a fatal result.

Our method of giving *thymol* and *betanaphthol* has not varied since we began our work, and we have found it simple, effective, and any change unnecessary, the only difference being in the dose,—four grammes of powdered *thymol* being used to two of *betanaphthol*. We have generally given it in capsules. In the evening a dose of either magnesium or sodium sulphate is prescribed, care being taken not to give an exhaustive purge; 30 grammes seem sufficient in most cases. The next day the patient is kept in bed without food until 1 P.M. Two grammes of *thymol*, or one gramme of *betanaphthol*, in capsule, is taken at 8 and 10 A.M., and at 12 M. another purge of salts; in the afternoon a light diet of milk is permitted. We always warn our patients against the solvents of *thymol* while it is in the digestive canal, and when in hospital diet our patients for a day before the exhibition of the drug.

This treatment is repeated each week until the worms are all expelled or the patient is so much better as to fail to return for treatment. I personally believe that many of the cases of so-called poisoning which have been chronicled as having been caused by *thymol* are either due to unwarranted overdose, such as the 10 grammes administered by Leichtenstern, or to excessive purging in a weak and anæmic individual, thus precipitating an exhausting and fatal diarrhoea. It is very much better to grade the dose according to not only the age but the relative strength of the patient. We have given

a half gramme to little children under five years of age; to those between five and ten, one gramme; between ten and fifteen, two grammes; between fifteen and twenty, three grammes; and between twenty and sixty, four grammes. Above sixty years of age two or three grammes are all that should be given.

Male fern will not expel *Necator americanus*. A notable proof of this was seen in a case of ours in which absolutely fresh and reliable specimens of this drug from two sources were administered in full dose on two occasions to the same patient. The highest number of uncinariæ expelled by either of these preparations was eight, while a dose of *thymol* of only three grammes administered a few days later brought away 3686 worms.

It is entirely unnecessary to mention the subsequent use of iron tonics. Careful blood-count of cases who did and of those who did not receive iron after-treatment failed to show any great increase of hæmoglobin from the use of the drug. We gradually ceased to give any tonics whatsoever.

Our most important results attained by the use of *thymol* and *betanaphthol* to expel worms can be synthesized as follows:

Thymol was administered to 40 hospital cases at intervals of one week. All fæces evacuated during the 24 hours following the time of receiving the anthelmintic were saved, washed on filters of gauze by specially-trained employees of the Commission, and the residue placed in a 10 per cent. formalin solution. From this residue the uncinariæ were recovered by steel forceps, and counted by us.

The finding of the Commission was that after *one* dose of *thymol* 76.85 per cent. of all uncinariæ were expelled; that after *three* doses of *thymol* 96.56+ per cent. were expelled; and that after *five* doses 98.75+ per cent. were expelled. Thus, in general terms, *five* doses of *thymol* are practically sufficient to cure a patient suffering from uncinariasis. Exceptionally more than five will be needed, but less than five may often be sufficient.

Betanaphthol was administered to 30 hospital cases under the same conditions as the *thymol*. One of the very peculiar effects noticed after its use was that it produced, in every single instance, a strong diazo reaction within a few hours. This diazo reaction disappeared very rapidly after six to twelve hours.

In concluding this short *résumé* of the clinical features of uncinariasis we omit, for lack of space, all discussion of the pathology and morbid anatomy, the prophylaxis and the diagnosis, as well as much more of interest in the history of the disease; but the desire has been to insist upon a more general recognition of uncinariasis as a clinical entity, and to throw light upon what many writers pass over with a few words which fail to reveal the picture we are called upon to recognize in the presence of the *disease*. It is needless to say that there is a great difference between *uncinariasis*, the *disease*, and the statement that eggs of uncinariæ have been found in the stool; for in most countries carriers form a majority of those under observation, and in such symptoms cannot be expected.

In citing the data brought forward in this paper I wish to invite attention to the collaboration of my colleagues, Dr. Pedro Gutierrez and Dr. W. W. King, who with myself formed the Porto Rico Anæmia Commission. Figs. 1 to 6 well show the nature of the country in Porto Rico, where the treatment of uncinariasis is being undertaken on a large scale.

ON THE TREATMENT OF PNEUMONIA

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THE cases upon which this article is based were observed in the winter of 1912-1913 at the Philadelphia Hospital. Thanks to the generosity of the visiting chiefs, I was able to follow carefully every case that was in the hospital for more than twenty-four hours; no criticism of any treatment is willingly made. I have endeavored simply to state as regards every method used:

1. Conditions present when treatment began.
2. The treatment and its application.
3. Conditions ensuing after the treatment.

In few prevalent disorders is treatment more varied and less accurately regulated than in pneumonia. "Many men, many methods," describes pneumonia's therapy as well to-day as yesterday. Different methods of treatment represent naturally the different attitudes of clinicians toward the idea of the disease's progress, some believing firmly that the course of a pneumonia is a fixed, specific thing, others feeling that they have been able to modify or even alter that course. Certainly the latter belief is the more human and, if rational, and in the application of its methods does no harm, should not deserve too hasty criticism.

According to these different attitudes of clinicians toward the idea of the disease's progress, we recognize treatment in pneumonia as

(a) Supporting,—that is, trying by what means we may to support the organism through the accepted period of toxæmia.

(b) Specific,—that is, trying by certain agents to cut short the period of toxæmia.

The term "supporting" must be taken broadly and should include most of the routine of treatment, from feeding to bleeding; the latter, when considered from the standpoint of the help given circulation, when properly applied, must surely take position in the supporting rank.

The term "specific" needs no describing; in these days the knowledge that a certain definite parasite causes a certain definite disease never fails to suggest to us antibacterial sera, vaccines and chemotherapy.

It has seemed to me that an acceptable presentation of the subject "The Treatment of Pneumonia" might be made by repeating or detailing the various accepted methods, more particularly, perhaps, describing the physiological action and the wished-for effect of drugs, sera, procedures, etc., and then, if possible, checking off the theoretical hope by comparison with the practical result. I prefer to draw no conclusions, leaving the reader that privilege, and must let him outline his own scheme of treatment.

Following out this idea as applied to the supporting method of treatment, we have to consider the *rationale* of the following, at least:

- I. The method of treatment by purely expectant means.
- II. The method of treatment by exposure to light and air.
- III. The method of treatment by elimination.
- IV. The method of treatment by local application.
- V. The method of treatment directed to maintain the heart's strength.
- VI. The method of treatment directed to the maintaining of the blood-pressure.
- VII. The method of treatment directed to the relief of the respiratory embarrassment.
- VIII. The method of treatment directed to the reducing of the temperature.

Following out the idea as applied to specific methods of treatment, there is for our consideration the development of the methods of treatment by

1. Antibacterial sera
2. Vaccines
3. Leucocytic extracts
4. Chemotherapy

It is hardly necessary to say that the combinations of Nos. 1 and 2 in the supporting method is the most generally accepted method of treatment to-day. No. 3 is rational and, if carefully applied, un-

doubtedly may do good; one might say that No. 2 in its workings covers the ground of every other supporting method save No. 4.

A

THE PRINCIPLES ON WHICH SUPPORTING METHODS OF TREATMENT ARE BASED

I. The Principles of the Purely Expectant Method.

The expectant method stands firm on several supports, none of which has ever been successfully assailed; its percentage of recoveries is as high as that of any other method. It claims that pneumonia is a self-limited disease, uninfluenced in its course by any medication, showing at times such quick recovery as to invalidate the claims of any procedure; doing damage to the heart of such nature that a drug could not be expected to have further effect upon it; affecting the vasomotor centre at times so severely and so specifically that only a real antitoxin unit could be expected to break up the destructive partnership of nerve-cells and toxin.

It avoids useless drugging and unnecessary discomforting applications and treatment and confines itself to proper and hygienic adjuvants. It will allow itself to be replaced by a real specific method of treatment whenever that shall appear. At present the expectant method is usually supplemented by exposure to light and air, and in the Philadelphia Hospital it is only by accident that a pneumonia patient does not appear promptly upon the "bridge."

The best single example of the results possible under the purely expectant method is the following case found in the venereal service, occurring early in the season, before the opening of the pneumonia ward. The patient was treated even without the usual exposure to light and air.

B. M., female, colored, 23 years, non-alcoholic, admitted November 6, 1912, for secondary syphilis; no previous pneumonia. On November 5, 1912, a chill, followed by a severe pain in her right side, cough, and expectoration of rusty sputum. Temperature, pulse-rate, and respiratory rate rose rapidly and followed the course outlined in Fig. 1.

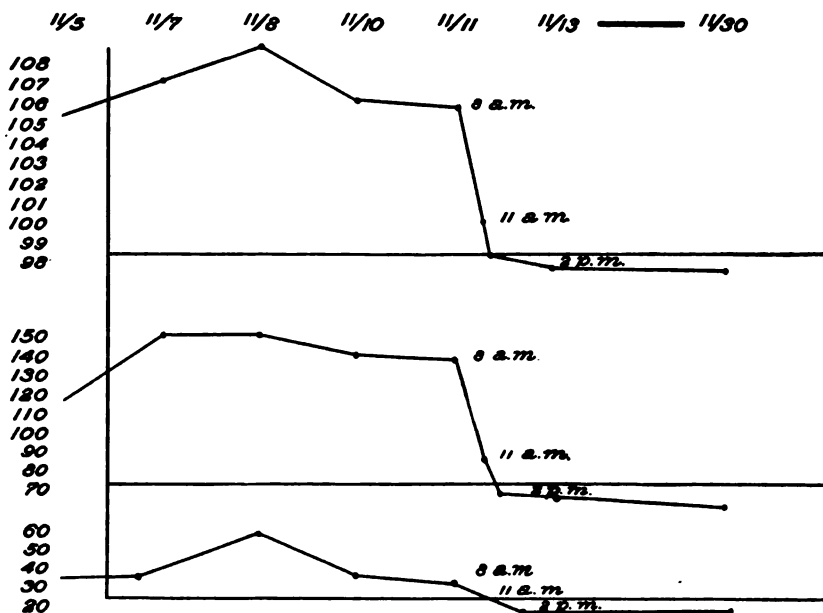
Outspoken dulness and tubular respiration over right upper front and back developed by the 6th. Highest leucocyte record 25,000 per cubic centimetre. Urine average condition: Specific gravity 1025; acid; no sugar; albumin trace; few hyaline and granular casts; diminished in amount during febrile period.

Slight confusional delirium. Pulse rapid, but of good volume and tension.

Treatment: Water, cracked ice, and milk diet. No untoward symptoms during the rapid drop of temperature; wanted to get out of bed two days after crisis. Lung cleared rapidly, note on the 13th saying "Impaired note front and back, slight harshness, few fine râles, heart sounds good."

SUMMARY.—A frank pneumonia of the right upper lobe associated with a temperature of 108°. A pulse-rate of 150 per minute, a respiratory rate of 60 per minute, was well in six days without the assistance of any drug or extra treatment beyond rest in bed.

FIG. 1.



Twelve other cases this winter were treated by the purely expectant method, plus, of course, the exposure to light and air, no drugs save a mild expectorant being administered. The short *résumé* of cases will show that they were typical pneumonias of varied degrees of severity. Many other cases belong really to the group, since the amounts of whiskey, strychnine, digitalis, caffeine, urotropin, and other drugs administered were so small that no effect could reasonably be expected, but since the intention was to exhibit a number of cases treated without stimulating drugs, they will not be considered among the purely expectant group of cases.

	Average temperature	Pulse	Respira- tion
A 2. 43, alcoholic. 1/9 to 1/12/13 Entire right lung involved. Delirious. Crisis 1/12/13. Urine 78 ounces. Complete recovery.	103 ^a	120	40
B 1. 23, alcoholic. 10/13 to 10/17/12 Right lower lobe involved. Termination by crisis. Complete recovery.	102 ^a	120	40
B 5. 40, alcoholic. 12/1 to 12/7/12 Right upper lobe involved. Urine—Albumin (†) and casts. Delirious. Developed erysipelas. Delirium cleared. Transferred to erysipelas ward, where sud- den death occurred with falling temperature, pulse- and respiratory rate.	100	120	50
B. Alcoholic. 1/10 to 1/19/13 Right lower lobe involved. Complete recovery. Crisis.	103	110	30
C. 47, non-alcoholic. 3/1 to 3/25/13 Left lower lobe involved. Termination by crisis. Completely well.	101	100	25
D. 40, alcoholic. 8/11 to 8/17/12 Right lower lobe involved. Termination by crisis. Complete recovery.	101 ^a	110	35
E. 28, alcoholic. 4/23 to 5/2/13 Right upper and lower lobe involved. A very ill man. Complete recovery after crisis.	103	120	35-55
H. 43, non-alcoholic. 4/3 to 4/20/13 Right lower lobe involved. Termination by lysis. Lung unresolved up to 5/17/13. Eventual com- plete recovery.	102	110	50
S. 38, non-alcoholic. 5/1 to 6/17/13 Right lower lobe involved. The average figures refer to the first ten days of illness. Pericarditis de- veloped. Was recovered from, only to be followed by an empyema. Operation eventual recovery.	102	110	35
S 2. 45, non-alcoholic. 3/1 to 3/8/13 Left lower lobe involved. Crisis. Complete recovery.	103	100	25
V. 49, non-alcoholic. 12/14 to 12/23/12 Left upper and lower lobe progressively involved. Termination by crisis. Complete recovery.	103	100	25
W. 36, alcoholic. 2/4 to 2/10/13 Right upper lobe involved. Very delirious. Termina- tion by crisis. Complete recovery.	102	120	30

II. The Principles of the Method of Treatment by Exposure to Light and Air.

The tonic effect of sunlight and open air on other acute and chronic pulmonary disorders is so evident that we have naturally, though but comparatively recently, been applying it to pneumonia. Northrup, of New York, is usually given credit for urging its adoption. It is claimed—

That in the sunlight contagion is less likely;

That in the fresh and cold air a patient gets more oxygen, and hence will be less cyanosed and likely to breathe more slowly;

That the peripheral vessels will be less dilatable and a good level of blood-pressure thus maintained;

That diuresis is promoted;

That delirium is lessened and cerebral symptoms modified by the cooling of the head;

That, under the influence of this ideal tonic, appetite and digestion are improved, the resistance heightened, and tendency to complication lessened.

G. W. Norris has given the collected results of this method as applied in previous years in the Philadelphia Hospital.

Aërotherapy may modify but certainly does not overcome pneumonia. Handicapped by the alcoholic history of the majority of the patients, this method has, in common with others at the Philadelphia Hospital, but poor chance to establish any unusual record.

In the last two seasons, October to June, of 297 cases given a reasonable period of exposure to open air 90 have died.

An apparent freedom from early cyanosis is the most noticeable result of the outdoor treatment of pneumonia.

Of 90 white adults placed at once in the open bridge wards this season, but 11 showed marked early cyanosis.

A respiratory rate of 40 per minute and over, persisting *more than two days after exposure on the bridge*, was noted in 28 of 116 cases.

In 20 recovering cases in which systolic blood-pressure estimations were made early and repeated after 48 hours, the figures were:

First estimation.	Second estimation.
115 mm.	90 mm.
120	120
115	105
85	105
110	95
95	95
105	110
150	135
120	115
135	120
120	105
130	120
105	90
145	115
120	120
110	110
105	105
110	105
105	110
110	115
130	125

The level of blood-pressure is at least fairly well maintained.

Diuresis.—In the cold wintry days diuresis was always a distinct feature in the bridge cases. In seven instances urine amounts averaging 60 to 90 ounces per day were recorded.

Delirium.—A delirium persisting for more than two days after exposure to the outside air on the bridge was noted in 34 of 116 cases.

Complications of the usual source were seen in the open-air cases. There were but two empyemas in the series of 116 cases, but, on the other hand, there were 5 serous pleural effusions, 6 instances of delayed resolution, 9 instances in which the pneumonia progressed from lobe to lobe, 1 instance of relapse, and 5 instances in which delirium developed after several days' exposure to the air.

In 40 cases recovering with crisis an exposure to the open-air treatment for an average of 4.1 days was recorded. Their history showed an average of 5.9 days of preceding illness.

III. Principles of the Method of Treatment by Elimination.

By the continuous giving of large amounts of water by mouth, water, or normal salt solution, subcutaneously, intravenously, or by the bowel, it is hoped that the circulating toxins can be in a measure washed out through the kidney. At the same time, since intestinal distention and stagnation are so often complicating events, it is hoped to relieve the stress upon the bowel by frequent early purgation. Bleeding, with subsequent intravenous injection of normal salt solution or hypodermoclysis, is advocated by some with the principle of active elimination of toxin in view.

The giving of water by mouth, plus exposure to light and air, equals in many cases the best results obtained by the more active methods of enteroclysis, hypodermoclysis, and intravenous injection. As mentioned above, in seven cases a polyuria *during the febrile period* ranging from 60 to 85 ounces in 24 hours was reached by these simpler means. Continuous enteroclysis owes its popularity to its partial resemblance to the treatment of peritonitis. One forgets that in pneumonia there is no absorbing drain in an abdominal wound, making a real intake from the bowel. A very large part of the fluid is expelled; the soiling of the bedclothes is as constant as the continuous injection. Extreme discomfort is at times complained of from the presence of the rectal tube, and in many delirious patients

the restlessness seems to be distinctly aggravated. *In none of the cases in which continuous enteroclysis was used did the eliminating polyuria exceed that produced by free administration of water by mouth.* Repeated hypodermoclysis was usually followed by a temporary distinct increase in the amount of urine passed. Just as large amounts, however, were voided by patients who received their water by mouth. Striking certain results, such as lowering of pulse-rate or respiratory rate, cessation of delirium or distress, were never observed in the severe intoxications at a time when they could be definitely referred to the subcutaneous injection. Acute distress is caused by the repeated injections. Extensive cellulitis of the breast occurred in one patient; in another I have noted that "even in delirium the pressure of the stethoscope on the swollen breast muscles causes him to cry out with pain." In still another, sore for days from the bruising of the tissues, the note was made that "at no time were the symptoms severe enough to justify this method of treatment."

There were 22 cases in which the effects of repeated or continuous administration of normal salt solution could be fairly discussed; in many other cases death ensued too shortly after treatment was instituted to allow of any rational opinion as to its value.

Of these 22 actively, repeatedly, treated cases 14 died. Of the 8 who recovered—

Crisis took place on day enteroclysis was begun in.....	1
Crisis took place before the first hypodermoclysis in.....	1
Neither the general condition nor the state of pulse or respiration demanded hypodermoclysis in	2
Crisis on the eighth day with an average amount of urine of 64 ounces in.....	1
Pericarditis and empyema developed in.....	1
An acute nephritis was recovered from in.....	1
Collapse four days after crisis and after eight days of continuous enteroclysis was seen in	1

A short *résumé* of cases treated by this method is given and the effects noted. The effects on blood-pressure where more than one reading was taken are given:

- a. 60, non-alcoholic. 10/21 to 10/27/12. Hypodermoclysis repeated for 5 days; extensive cellulitis..... Death.
 - a 2. 29, non-alcoholic. Hypodermoclysis each day. Temperature, pulse, or respiration unaffected. Urine 60 to 90 ounces..... Recovered.
 - b. 27, non-alcoholic. Hypodermoclysis twice a day without effect on delirium, temperature, pulse, or respiration..... Death.
- VOL. III. Ser. 23—4

- b 2. 56, alcoholic. Hypodermoclysis twice a day without effect on delirium, temperature, pulse, or respiration Death.
- b 3. 40, alcoholic. Continuous enteroclysis for 48 hours without effect on delirium, temperature, pulse, or respiration. No increase in the amount of urine..... Death.
- b 4. 36, non-alcoholic. Continuous enteroclysis. Crisis on the eighth day. Maximum amount of urine 64 ounces. A favorable case..... Recovered.
- c. 56, alcoholic (?). Continuous enteroclysis for 4 days. No crisis. Progression from lobe to lobe. Parotiditis. No effect on temperature, pulse, or respiration. Fourteen days after admission Death.
- d. 63, non-alcoholic. Repeated hypodermoclysis. Pulse, respiration, increase of urine 20 to 24 ounces..... Death.
- d 2. 64, alcoholic. Hypodermoclysis twice a day. Enteroclysis at night. No discernible effect on delirium, temperature, pulse, or respiration Death.
- f. 54, alcoholic. Hypodermoclysis and enteroclysis. Very ill. No appreciable effect on temperature, pulse, or respiration Death.
- g. 71, non-alcoholic. Hypodermoclysis each day. Enteroclysis q. 60 h. Intravenous injection of normal salt solution 24 hours before death. No effects on temperature, pulse, or respiration, which steadily went up. Was passing 50 ounces of urine before treatment was instituted; dropped to 45 ounces..... Death.
- h. 47, alcoholic. Continuous enteroclysis. Crisis took place day enteroclysis started, it being the eighth day of disease..... Recovered.
- h 2. 35, non-alcoholic. Repeated hypodermoclysis. Very ill and delirious. Very sore from hypodermoclysis. Jaundice. Temperature, pulse, respiration, and delirium unaffected. Urine rose 30-60-80 ounces. Blood-pressure fell during treatment..
- k. 33, F. alcoholic. Hypodermoclysis q. d. Crisis before hypodermoclysis was done. Blood-pressure fell during treatment..... Recovered.
- m. 43, alcoholic. Repeated. Hypodermoclysis. Enteroclysis started one week later. Hemorrhagic nephritis. After six days of treatment urine 24 to 26 ounces. Blood-pressure fell 118 mm. to 99 mm. Temperature, pulse, respiration unaffected and kept up till crisis, three days after hypodermoclysis was begun..... Recovered.
- n. 51, alcoholic. Enteroclysis q. 6 h. Urine increased. No effect on temperature, pulse, respiration, or delirium. No effect on irregular heart action..... Death.
- o. 43, alcoholic. Streptococcus infection of finger. Continuous enteroclysis. No distinct effect on temperature; pulse and respiration steadily increased. Urine increased 24 to 51 ounces ... Death.
- p. 45, non-alcoholic. Continuous enteroclysis. Urine increased 47 to 54 ounces. Crisis after 12 days. Tongue remains persistently dry. Temperature never over 102. No appreciable effect on temperature, pulse, or respiration. Four days after crisis a collapse, from which he Recovered.
- s. 38, non-alcoholic. Enteroclysis. One pint every 4 hours. No effects on temperature, pulse, or respiration. Developed pericarditis and empyema. Urine averaged 42 to 72 ounces. Operation Recovery.
- s 2. 70, non-alcoholic. Continuous enteroclysis from 1/3 to 1/7/13. No effect on temperature, pulse, or respiration, which steadily increased. Delirium developed; incontinent..... Death.

- t. 48, non-alcoholic. Hypodermoclysis on 2/13 and 2/14. Crisis on 2/13. Temperature, pulse, and respiration never high. Came down with crisis. Urine increased 17 to 43 ounces. Recovery.
- t 2. 30, alcoholic. Hypodermoclysis on 4/26. Urine 68 ounces before hypodermoclysis; 58 ounces in the 24 hours after. Temperature, pulse, respiration, absolutely unaffected. Death.
- w. 58, alcoholic. Under hypodermoclysis blood-pressure dropped 110 to 90. Urine 46 ounces to 25 ounces. No beneficial effect seen on temperature, pulse, or respiration Death.

Distinct eliminative results of polyuria were better obtained in the Philadelphia Hospital cases by the frequent administration of water by mouth. No noteworthy effects, such as lessening delirium, reduction of the respiratory or pulse-rate, were observed in any of the severe cases as a direct result of bleeding, plus intravenous injection of salt solution, intravenous injection alone, hypodermoclysis, or enteroclysis. The severe pain and cellulitis recorded in the cases receiving repeated hypodermoclysis preclude our saying of it "at least it can do no harm."¹

IV. The Principles of the Treatment by Local Applications, Such as Ice, Poultices, Cupping, Jackets, etc.

By acting as counterirritants, drawing blood to the surface of the skin and thus, possibly, in a thin person, relieving the congestion of the parietal pleura, fixing the chest-wall to a certain extent, the intense pleural pain is modified in the early stages. It was hoped also that ice could prevent the spread of the inflammation through the lungs. Ice as an application to the chest is but rarely used at present in the Philadelphia Hospital. The enthusiastic reports of several years ago, the supposedly high percentage of cures (Mays, 195 cases with 7 deaths) under this method of treatment, have long since been disproved. An occasional poultice is used, jackets are at times ordered. Cupping is popular and is still used in about 50 per cent. of all cases, with apparent relief at times. My own impression was that relief was obtained by the necessary limitation of the chest movement when the cups are in place. The modifying of the acute pleural pain in the early stages must mean much in the preserving of a patient's nervous strain. Strapping, if applied so as not to interfere

¹ See also a case of fatal infection by the gas bacillus caused by repeated hypodermic injection of large amounts of normal salt solution: J. H. Musser and N. B. Gwyn.

with a functioning part of the lung, seems to give more complete rest from irritation than any other application.² It seems almost conclusive that local treatment can only have one result,—that is, relief of pain,—and it is hardly worth while to make comparison of methods so limited in their sphere of action. The effect of the relief of pain is spoken of later in the section on methods of treatment directed to relief of respiratory embarrassment.

V. The Principles of the Treatment Directed to the Maintenance of the Heart's Strength.

The idea of the extreme expectants that during the acute infection the heart is completely under the influence of the pneumonia toxins and refractory to all other influences is vigorously combated by many. It is held that the heart can be influenced through its nervous supply (vagus), and that, so long as the heart muscle is not in an extreme stage of degeneration, response to stimulation can take place. The most common cardiac stimulants or methods of stimulating or aiding the heart in general use at present may be grouped thus:

1. Digitalis, strophanthus, strychnine, caffeine, cocaine, atropine.
2. Camphor, alcohol, and ammonia.
3. Hydrotherapy, injection of normal NaCl solution intravenously, hypodermically, or into the bowel.
4. Bleeding. With the exception of hydrotherapy, group 3 has had its principles detailed; it is discussed in the next section. Some separate description of the action of the members of the other groups must be made.

Digitalis.—At one time praised as a specific in pneumonia, digitalis has fallen to the level of a debatable heart stimulant. One cannot gainsay the pharmacological experiments with digitalis and strophanthus, the direct action of these drugs upon a normal heart muscle of animals is readily shown. One cannot prove that these drugs did not prevent cardiac dilatation and loss of tone in the many cases in which they were used, but one can state emphatically that even in large and continuous doses they fail to slow the heart whose

²It is evident, of course, that the most any local treatment can do will be to slightly affect the parietal pleura. In the early stages of a pleurisy with two rubbing membranes there can be no vascular connection, and the affected lung itself is anatomically beyond reach.

pacemaker is being fed with unneutralized pneumococcus toxins. They also probably fail to raise the blood-pressure. McKenzie ("Heart," 1911-12) states: "Moreover, when the heart is affected by agents which increase its excitability the digitalis has little effect upon the rate." "This failure of effect is also evident in conditions where the heart is affected by poisons, simple or microbic, as for instance alcohol, the poisons of infectious diseases, the specific agent in rheumatism, and the various infective affections of the heart."

"Tachycardias with the contraction starting at the normal place are due, as a rule, to some toxin or fever, tuberculosis, alcohol, or acute pneumonia. So far I have found such hearts unaffected by digitalis even when pushed to the extent of nausea and vomiting."

He gives the following examples:

F., 28 years, tuberculosis of lungs. Temperature 100 to 103. Pulse-rate: October 23, 82; 24th (tincture digitalis, 1 drachm per day), 84; 25th, 110; 26th, 100 (vomiting); 27th, 100 (vomiting); 28th (mm. xx), 110; 29th (stopped), 120 (no further vomiting).

F., 30, tuberculosis of lungs. Temperature 100. Pulse-rate: October 24, (tincture digitalis, 1 drachm per day), 90; 25th, 90; 26th, 80; 27th, 100; 28th, 100 (headache); 29th, 90 (nausea); 30th, 96 (nausea).

F., 36, tuberculosis of lungs. Temperature 99 to 100. Pulse-rate: October 23, 96; 24th (tincture digitalis, mm. xx, t. i. d.), 96 to 90; 25th, 100; 26th, 80; 27th, 100 (headache and sick); 28th (mm. x), 90; 29th, 100 (sick); 30th (stopped), 90 (sick).

In the Philadelphia Hospital cases last winter digitalis was given frequently in two forms and probably for two distinct purposes. The infusion of digitalis in a small dose, 3ii, frequently given as a mild diuretic, is probably without any save diuretic effect. The tincture is probably given as a cardiac stimulant, either to slow the heart or to help in the maintaining of its tone and muscular strength. Whether or not these effects are reached or obtained can be judged from consideration of the cases here detailed.

	Pulse	Blood-pressure	Urine	
A. Tr. dig. t. i. d. $\overline{\text{m}}$ x 3 iv taken for 8 days.....	120	...	83 ounces	Recovery.
Crisis.....	80			
A 2. Tr. dig. $\overline{\text{m}}$ x t. i. d. 3 iv taken for 8 days.....	120	...	34 ounces	Recovery.
Crisis.....	90			
B. Tr. dig. $\overline{\text{m}}$ x q. 3 h. 3 iv taken for 3 days.....	80	120	32 ounces	Death.
	140	120		

	Pulse	Blood-pressure	Urine	
B 2. Tr. dig. \overline{m} x q. 3 h. $\overline{3}$ vi taken				
2/25.....	70	...	32 ounces	
from 2/25 to 3/1/13	70	...	40 ounces	Recovery.
B 3. Digitalone \overline{m} xx q. 3 h $\overline{3}$ vi taken				
for 6 days.....	120	...	.....	Death.
	130			
B 4. Digitalone \overline{m} x q. 4 h. \overline{m} lxxx				
taken for 32 hours	120			
	130	.....		Death
C. Tr. dig. \overline{m} x q. 3 h. to \overline{m} clx, \overline{m} v				
q. 3 h., to \overline{m} cclxxx taken in 1				
week	80	...	54 ounces	Recovery.
	100			
C 2. Tr. dig. digitalone from 10/3 to				
10/17 amount?.....	120	...	.....	Death.
	140			
C 3. Tr. dig. \overline{m} x q. 4 h. from 12/31 to				
1/5 $\overline{3}$ xii taken	120	95		
	120	85	64 ounces	T. B. disch.
C 4. Digitalone \overline{m} xv q. 4 h. $\overline{3}$ ii taken				
for 8 days.....	140			
	130	...	38 ounces	Death.
C 5. Tr. dig. \overline{m} x q. 3 h. from 3/5 to				
3/10. $\overline{3}$ vi \overline{m} xl taken	100			
	90	...	.....	Recovery.
Quite irregular				
D. Tr. dig. \overline{m} x q. 4 h. from 10/8 to				
10/13 $\overline{3}$ v taken	120	130		
	130	90	24 ounces	Death.
D 2. Tr. dig. \overline{m} xv from 11/15 to				
12/13 $\overline{3}$ iiss. taken	70			
	80	...	.....	Recovery.
D 3. Tr. dig. \overline{m} v q. 3 h. from 2/20 to				
3/13 $\overline{3}$ xiv taken,	120			
	90			
A little fluid accumulating in the				
left chest sent pulse up in spite				
of 12 days preceding digitalis. .	100	...	.....	Recovery.
D 4. Tr. dig. \overline{m} x t. i. d. from 3/18 to				
3/29 $\overline{3}$ v taken; pulse unchanged				
after 11 days of administration. .	120	...	.....	Death.
D 5. Tr. dig. \overline{m} x t. i. d. from 3/3 to				
3/10 $\overline{3}$ iii taken.....	110			
Crisis.....	80	...	.....	Sudden death.
F. Tr. dig. \overline{m} x t. i. d. from 2/28 to				
3/12 $\overline{3}$ vi taken	100	150		
Crisis.....	90	135	44 ounces	Recovery.
F 2. Digitalin gr. 1-50 q. 3 h. from 2/10				
to 2/12 gr. 1/3 taken; pulse				
remains at.....	150	...	.....	Death.
G. Tr. dig. \overline{m} v q. 3 h. till \overline{m} xl, then				
\overline{m} x q. 3 h. till \overline{m} lxxx taken, total				
$\overline{3}$ ii	110	140	50 ounces	
	130	110	45 ounces	Death.
H. Tr. dig. \overline{m} vi q. 3 h. \overline{m} xliii taken				
in 24 hours; pulse steadily rose. .	120			
	150	...	.....	Death.
H 2. Digitalin 1/10 gr. q. 3 h. 4/5 gr.				
taken in 24 hours; pulse rose				
steadily.....	110			
	120	...	.....	Death.

		Pulse	Blood-pressure	Urine	
M.	Tr. dig. $\frac{m}{x}$ t. i. d. $\frac{3}{iii}$ taken for 6 days, pulse rose.....	120	90		
	Digitalone $\frac{m}{xx}$ q. 4 h. $\frac{3}{ii}$ and $\frac{m}{xl}$ taken; pulse rose.....	140 120 140	70		
M 2.	Digalen $\frac{m}{x}$ b. d. for 3 weeks, then tr. dig. $\frac{m}{vi}$ for 2 weeks q. 3 h.; pulse rose.....	100 130	...	.....	Death.
M 3.	Tr. dig. $\frac{m}{v}$ q. 3 h. $\frac{3}{iii}$ $\frac{m}{xx}$ taken, a boy of 16; pulse remained steadily till crisis.....	130 90 70	...	.....	Death. ¹
M 4.	Digitalone $\frac{m}{x}$ hypodermically q. 4 h $\frac{m}{xxx}$ taken. Pulse.....	130 90 120	...	40 ounces 50 ounces	Recovery.
M 5.	Tr. dig. $\frac{m}{x}$ q. 3 h. $\frac{3}{ii}$ $\frac{m}{xl}$ taken. Crisis.....	120 90	110	60 ounces	Recovery.
O.	Tr. dig. $\frac{m}{x}$ q. 3 h. $\frac{3}{v}$ $\frac{m}{xx}$ taken. Pulse rose.....	120 140	90 100	.....	Recovery.
O2.	Tr. dig. $\frac{m}{x}$ q. 4 h. $\frac{3}{iii}$ taken. Pulse remains steadily 120, drop to.....	90 90	...	.....	Recovery.
P.	Tr. dig. $\frac{m}{v}$ from 5/8 to 5/14 $\frac{3}{iv}$ taken. Pulse steadily at.....	100 80	...	70 ounces	Recovery.
R.	Tr. dig. $\frac{m}{x}$ t. i. d. $\frac{3}{iii}$ taken. Pulse remains steadily at.....	140 110	...	.....	Recovery.
S.	Tr. dig. $\frac{m}{xv}$ t. i. d. $\frac{3}{xxx}$ taken. Pulse 130 to.....	120	...	.....	Death.
S 2.	Tr. dig. $\frac{m}{x}$ t. i. d. from 3/1 to 3/13. $\frac{3}{vi}$ taken. Pulse remained at 120 till crisis, dropping to.....	80	...	.....	Recovery.
T.	Tr. dig. $\frac{m}{v}$ q. 3 h. for five days. $\frac{3}{iii}$ $\frac{m}{xx}$ taken from 2/23 to 3/12 $\frac{m}{v}$ q. 3 h. $\frac{m}{xi}$ taken. Pulse remained at.....	90	125	.....
	Pulse rose after xi of digitalis from 80 to 100 as result of a small lobulated empyema containing about 1 ounce of pus..		...	54 ounces	Recovery.
V.	Tr. dig. $\frac{m}{xv}$ q. 3 h. in 24 hours $\frac{3}{ii}$ taken. Pulse unchanged at 120		...	.....	Death.
W.	Tr. dig. $\frac{m}{v}$ t. i. d. $\frac{3}{i}$ and $\frac{m}{xv}$ taken. Pulse rose.....	100 130	...	.....
	to.....	130			
	Dropped in crisis to.....	100	...	.....	Recovery.
	then.....	80			
W 2.	Tr. dig. $\frac{m}{xx}$ q. 4 h. 1 ounce taken. Digitalone $\frac{m}{x}$ t. i. d. for 4 days ii taken; pulse remained.....	140	...	.....	Death
W 3.	Tr. dig. $\frac{m}{x}$ q. 4 h. $\frac{3}{i}$ in the 24 hours. Pulse rose from 120 to 130		...	54 ounces	Death.
Y.	Tr. dig. $\frac{m}{v}$ q. 3 h. $\frac{3}{v}$ $\frac{m}{xx}$ taken. Pulse remained at.....	120	...	.....	Recovery.

In not one of forty cases vigorously dosed with digitalis was the pulse-rate even perceptibly reduced except in coincident crisis. More remarkable is it that even after crisis and neutralization of circulating toxin,—i.e., removal of stimulus,—the administered digitalis produced no brachycardia.

“The heart is far less sensitive to the action of digitalis when its contraction begins with the normal action of the auricle” (*McKenzie*).

The effect upon the blood-pressure in the cases which could be followed is seen to be less than nothing. The diuresis recorded in some of the cases could as well be ascribed to the water ingested as to digitalis.

Strophanthus.—This drug was not used sufficiently often or in cases sufficiently controlled by personal observation to allow me to make any statement as to its action.

Strychnine.—According to Cushny, “Strychnine seems to be of benefit in some cases of heart-disease, and is often supposed to have a direct action on that organ. Any improvement which may be produced by it, however, must be attributed to the constriction of the vessels, and the indications for its use would seem to be a low blood-pressure. Crile denies it any value in the treatment of the low blood-pressure of shock, however, and Cabot could not find any change in the blood-pressure after its use in a number of conditions in which it is ordinarily advised. There seems no question that its value in heart-disease is often overestimated, and that little dependence can be placed on its benefiting these cases.” Strychnine is given in almost a routine manner, in fifteen consecutive cases the pulse-rate and respiratory rate are recorded, the effect on the blood-pressure is shown in cases B, C 1, C 2, E, K, L 1, L 2, M 1, M 2, M 3.

		Pulse	Respira- tion	Blood- pressure	
H.	$\frac{1}{2}$ gr. t. i. d. for four days. Hypoder- moclysis.....	120 120	45 40		
L.	$\frac{1}{2}$ gr. q. 3 h. for 5 days.....	90 70	30 20		
K.	$\frac{1}{2}$ gr. q. 3 h. for 4 days.....	120 90	60 25	118 110	Crisis. Crisis.
L.	$\frac{1}{2}$ gr. b. d. for 2 days.....	120 100	40 40	105 90	T. B. dischg.

	Pulse	Respira- tion	Blood- pressure	
L 2. $\frac{1}{10}$ gr. q. 4 h. Hypodermoclysis for 7 days.....	130 120	40 40	90	
M. $\frac{1}{10}$ gr. t. i. d. Hypodermoclysis for 7 days.....	100 100	40 50		
M 2. $\frac{1}{10}$ gr. q 3 h. for 10 days	120 102	45 25	145 112	
M 3. $\frac{1}{10}$ gr. q 3 h boy of 17 for 7 days	130 120	40 60	120 120	
M 4. $\frac{1}{10}$ gr. q 3 h. Hypodermoclysis for 3 days.....	130 130	30 40		
C. $\frac{1}{10}$ gr. q 3 h. for 8 days	100 100	25 25	110 95	
B. $\frac{1}{10}$ gr. hypodermoclysis q 3 h. for 2 days..	110 130	40 60		
B 2. $\frac{1}{4}$ gr. q. 3 h. for 4 days.....	90 150	30 50	88 105	
C 2. $\frac{1}{10}$ gr. q. 4 h. hypodermoclysis for 6 days.....	130 120	55 35	95 85	
D. $\frac{1}{10}$ gr. q. 3 h. for 13 days	120	35	...	Crisis.
(Death after crisis) (irregular heart)...	120	25		
E. $\frac{1}{10}$ gr. q. 3 h. for 3 days	100 100	40 30	105	Crisis.
G. $\frac{1}{10}$ gr. q. 3 h. for 5 days	150 150	50 40		
M 5. $\frac{1}{10}$ gr. t. i. d. for 2 days.....	120 140	30 50		
M 6. $\frac{1}{10}$ gr. hypodermoclysis q. 4 h. for 3 days.....	130 110	30 40		

It seems perfectly evident from the above figures that so long as the poisons of the pneumonia are circulating little or no effect is exerted on pulse-rate, respiratory rate, or the blood-pressure by the use of strychnine.

Caffeine.—At the present time caffeine is being frequently used as a safe stimulant. It is said to bring about a rise in the blood-pressure by its action on the vasomotor centre. It supposedly acts on the heart itself, increasing its irritability, and accelerating it at first. The action is then exerted on the inhibitory centre in the medulla, and slowing of the heart takes place. Experimentally, even when the accelerans is cut and vagi are paralyzed, the action is still marked. Respiration is quickened and strengthened by action on the medullary centre. Diuresis is usually produced. A few cases could be followed in the Philadelphia Hospital series this winter. It was given in others, but not in a continuous manner, or too soon before death, to allow of any consideration as to its action.

	Pulse	Respira- tion	Blood- pressure	
C. Caffeine sodium benzoate, gr. i, hypo- dermically, t. i. d., for 3 days, 64 ounces urine. Pulse for 3 days.....	130	40	90	Crisis.
4th day.....	120	35	85	Recovered.
K. Caffeine sodium benzoate, grs. iii, t. i. d., from 1/13 to 1/15. No polyuria. 1/13.	120	50	118	
1/15.....	90	35	104	Crisis.
M. Caffeine sodium benzoate, grs. iii, hypo- dermically, q. 3 h. for 4 days. An irregular pulse. No effect upon pulse, which remained quite irregular. No polyuria.....	80	30	...	Recovered.
	90	25		
S. Caffeine citrate grs. v, q. 3 h. for 24 hours	130	40	125	
	140	55	125	Died.
S 2. M., 47 years, alcoholic; day of disease? irregular temperature 6/8.....	120	30	150	
Previous arthritis right upper lobe. 6/9 .	120	30		
Caffeine sodium benzoate, grs. vii hypo- dermically, t. i. d., from 6/8 to 6/11. Progressively failed.				
6/10.....	130	40		
6/11.....	120	40	130	Death.

These are undoubtedly too few cases to let any fixed opinion be formed. What is clearly evident, however, is that the continued use of the drug, either hypodermically or by mouth, does not produce what one can call positive effects which are removed surely from the influence of crisis. So long as the stimulus of the pneumococcus toxin is being exerted on the centres, just so long, apparently, will the ordinary drugs upon which we depend be absolutely without effect.

Cocaine.—Cocaine has been called into use more or less extensively in recent years, rather vaguely no doubt, as a respiratory and cardiac stimulant. "The heart is much accelerated in mammals." "The respiration after cocaine is much accelerated, owing to central stimulation; as the acceleration progresses the air inspired with each breath gradually becomes less." "The vessels are much contracted, and this, together with the increase of the heart-rate, leads to a very considerable rise in the blood-pressure" (*Cushny*). An accelerator of the pulse, and a drug that both accelerates and makes more shallow the respiration, cocaine can only depend upon its further action in raising blood-pressure for its acceptance into the "treatment of pneumonia."

	Tempera- ture	Pulse	Respira- tion	Blood- pressure	
F. Cocaine $\frac{1}{2}$ gr. hypodermically q. 4 h.					
2/28/13.....	100	120	25		
3/1.....	104 ^a	120	45	120mm.	
3/2.....	104	110	30	123	
3/3.....	102	100	40	115	
	99	80	30	115	Crisis.
3/4.....	99	90	30		
K. Cocaine $\frac{1}{2}$ gr. hypodermically q. 4 h.					
1/11.....	103	110	45		
1/12.....	102	115	60		
1/13.....	100	110	55		
1/14.....	100	120	50	118	
1/16.....	99	100	40		
1/17.....	98 ^a	90	35	104	Crisis.
R. Cocaine $\frac{1}{4}$ gr. hypodermically q. 3 h.					
1/7.....	102	120	40		
1/8.....	103	130	50		
1/9.....	103	116	50	144	
1/10.....	102	140	60	165	Death
T. Cocaine $\frac{1}{2}$ gr. hypodermically b. d. A very mild case.					
2/13.....	101	95	35	112	
2/14.....	99	95	35		
2/14.....	97 ^a	60	25	113	
2/15.....	98 ^a	70	115	115	

Cocaine is not used extensively in the Philadelphia hospitals. Only those cases in which its effects might be followed are recorded. It was used in many other cases, and frequently used in association with quinine and urea, but, since its main value must be in the action on the blood-pressure, only those cases in which blood-pressure records were carefully followed will be reported.

Atropine.—Of atropine as a heart stimulant but little will be said. "It accelerates the heart, increases the extent of the systole, decreases the diastole, augments the output per minute the blood-pressure may be increased" (*Cushny*).

The frequent prescribing of atropine in the Philadelphia Hospital cases is probably more for some effect upon respiration and pulmonary conditions; the acceleration of an already accelerated heart would offset any theoretical advantage to be gained by any increase of systole or decrease of diastole. For results with reference to the heart one is referred to the section dealing with respiration.

Camphor, Alcohol, and Ammonia.—Camphor, in view of its popularity, must be considered somewhat at length. It is freely used at present; there are many enthusiastic reports of its action as a cardiac stimulant and supporter of the blood-pressure. "It has been used apparently with success in the depression and weakness of acute

fever. In many of these a marked improvement in the pulse has been observed after camphor. This, like the similar improvement seen after alcohol, may perhaps be explained by its action as a local stomachic irritant, producing changes in the circulation reflexly" (*Cushny*). "The heart is sometimes slowed by camphor, but is generally little affected in either strength or rate."

"In clinical experiments camphor injected subcutaneously in oil in doses as large as 50 grs. fails to produce any effects. Variations in pulse and blood-pressure occasionally following the use of the drug were so inconstant as to make it probable that they had no relation to the medication employed."

"Therefore, while camphor may be an active agent in certain disorders, it nevertheless should neither be relied upon as a cardiac stimulant nor feared as a toxic agent" (*Heard and Brooks, Am. Jour. of Med. Sci.*, Feb., 1913). In not enough of the Philadelphia Hospital cases is camphor used to give any deducible results. The effects on the pulse and blood-pressure after continuous administration can be seen in two cases, O and T.

	Temperature	Pulse	Respiration	
A. 29 years, camphorated oil, π xx hypodermically, q. 3 h. Never any real need and no effect could be noted.				
1/11	101 ⁴	110	30	Recovered.
1/12	103	120	40	
B. 27 years, camphorated oil, camphor grs. iii, hypodermically, q. 3 h. 2/24....	103	120	40	Died.
No effect of either temporary or permanent character. 2/25	102	120	40	Died.
M. 34 years, camphorated oil, π x q. 4 h. hypodermically for 24 hours.	{ 102 104	130	40	Recovered.
		130	40	
M. 31 years, gr. iii hypodermically q. 4 h., 18 grs. given. Temperature, pulse and respiration all went up, absolutely no effect could be seen following the injections either temporary or permanently	{ 102 104	130	45	
		140	40	
M 2. 32 years, camphorated oil π x hypodermically, t. i. d. for 3 days. Pulse always weak; absolutely no action could be seen either immediately following the injections or subsequently.				
4/7	102	100	60	Sudden death
4/10	101	100	60	
4/27 .....	...	...	..
N. π xv hypodermically (camphorated oil) Stat. Absolutely no effect. ....	...	...	..	Death.

		Temperature	Pulse	Respiration	Blood-pressure	
O.	43 years, camphorated oil π xx hypodermically q. 2 h. No reaction of any sort could be noted either immediately after injection, or of a later general character					
	1/8.....	103	120	30	90	
	1/10.....	102	120	35		
	1/11.....	103	140	60	100	Death.
S.	70 years, camphorated oil π v hypodermically t. i. d. An irregular heart with extrasystoles every 4 or 5 beats. Absolutely unaffected by the administration of camphor.					
	1/3.....	103	120	40		
	1/6.....	101 ⁴	120	40		Death.
T.	48 years, camphor gr. iii 8 A.M. 2 P.M. Both adrenalin and cocaine were given as well in this case. The persistent level of blood-pressure is noticeable, but judging from the pulse-rate and general symptoms he was never an ill man....					Recovery.
	2/13.....	101	95	35	112	
	2/14.....	99	60	25	113	
	2/15.....	98	60	25	115	
T 2.	25 years, camphorated oil grs. ii at 10 A.M. and 4 P.M. each day from 4/26 to 4/29.					
	4/26.....	104	120	35	120	
	4/29.....	102	120	30		Death.

One may draw what conclusions they will from the figures here presented. What is most apparent is that camphor neither strengthened the pulse nor reduced its rate, did not increase blood-pressure in the cases in which it could be followed, did not have any favorable effect on the respiration.

Alcohol.—One hesitates to continue the discussion as to alcohol's value. "It may be stated at once that there exist two distinct views as to the action of alcohol on the central nervous system: the one strongly upheld by Binz and his pupils, that alcohol first stimulates, then depresses, the nerve-cells; the other championed by Schmiedeberg, Bunge, and their followers, that it depresses the central nervous system from the beginning."

"On the whole, the action on the circulation of small quantities of alcohol (3ss-3i) may be favorable by augmenting the strength of the contraction of the heart, but this action is so slight and inconstant that it is impossible to regard it as a basis on which serious therapeutics can be founded." "The slowing of the heart which often follows the administration of alcohol in fever would seem due rather to its diminishing the cerebral excitement, and hence muscular ex-

ertion, than to its direct action on the heart. On the other hand, the alleged improvement of the circulation in shock may be due to a reflex from the irritant local action, and perhaps to the direct cardiac action" (*Cushny*). Alcohol is frequently used in the cases at the Philadelphia hospitals. One readily realizes how impossible it is to estimate just how much influence the alcohol administered might have. I can only do for the cases taking alcohol what I have done for other cases under other methods of treatment,—i.e., give the doses and the subsequent reaction on temperature, pulse, respiration, or blood-pressure, as indicated by the figures where these are well and consecutively taken.

		Tem- pera- ture	Pulse	Res- pira- tion	Blood- pres- sure	
H.	35 years, alcohol 1½ ounces q. 3 h. Delirious.					
	2/1.....	102	130	30	142	
	2/3.....	102	120	35		
	2/4.....	102	110	40	125	Death.
K.	33 years, alcohol ½ ounce q. 3 h. For 6 days delirious.					
	1/11.....	103	110	45	118	
	Crisis 1/17.....	98 ^a	100	25	104	Recovery.
L.	45 years, alcohol 1 ounce q. 3 h. Delirious.					
	4/6.....	102	110	40	130	
	4/7.....	104	140	50	120	Recovery.
L 2.	26 years, alcohol 1 ounce t. i. d. Delirious.					
	2/22.....	103	130	40		
	3/3.....	100	120	30	90	
	3/4.....	102	100	30	120	T. B. discharged.
R.	56 years, alcohol ½ ounce q. 3 h. Not delirious.					
	1/8.....	103	130	60	144	
	1/10.....	102	140	60	165	Death.
S.	49 years, alcohol ½ ounce q. 3 h. Not delirious. Empyema.					
	1/8.....	102	120	40	100	
	1/10.....	101	120	35	100	Death.
T.	45 years, alcohol 1½ ounces t. i. d. Not delirious.					
	2/11.....	102	110	45	118	
	2/12.....	101	130	50	105	
	2/15.....	97	130	65	...	Death.
B.	40 years, alcohol ½ ounce q. 2 h. 6 ounces taken. Death on day of admission Wildly delirious.					
	1/3/12.....	102	120	50		
		102	130	40	...	Death.
B 2.	42 years, alcohol ½ ounce q. 4 h. Not delirious.					
	1/17.....	101	110	30	115	
	1/18.....	103	110	30		
	1/19.....	101	100	25		
	1/20 5 A.M. to 11 A.M. Crisis.	101	85	20		
		98	70	20	105	Recovered.

	Tem- pera- ture	Pulse	Res- pira- tion	Blood- pres- sure	
B 3. 36 years, alcohol ss q. 3 h.					
3/7.....	100	140	40	120	
3/8.....	99	100	30	120	Recovered.
Crisis beginning.					
C. 49 years, alcohol 3 iv q. 4 h.					
Delirious.					
1/1.....	101	130	40	95	
1/5.....	100	120	33	85	T. B. discharged.

Many others were given alcohol, but no good figures of pulse, respiration, or blood-pressure could be made during its administration, since too small amounts were given or death or crisis ensued too soon after alcohol was prescribed. One cannot say that any marked effect is shown in these figures, no real discernible effect could ever be made out in the pulse-rate or pulse strength following the doses of alcohol. In the delirium shown by these patients such an improvement would be hard to detect. No instance of rapid fall in blood-pressure presumably due to alcohol can be seen. Two cases, L² and C, show a remarkably good upkeep of blood-pressure level after long administration.

Ammonia.—"The carbonate of ammonia and the spirit are often given in case of collapse or sudden heart-failure. They are generally administered by the mouth, and probably act here not directly on the heart and respiratory centre, as has been supposed, but reflexly from gastric irritation. They have also been injected subcutaneously, or even intravenously, for this purpose, and here the local action may be reinforced by a direct action on the medulla. The action lasts only a very short time, but is often sufficient to tide the patient over an acute collapse" (*Cushny*). There are no figures of interest as regards the use of ammonia in the treatment of pneumonia in the Philadelphia Hospital cases this winter.

Hydrotherapy—*Injection of Normal Salt Solution, Intravenously, Hypodermically, or by the Bowel.*—Hydrotherapy as a method of stimulating the heart in pneumonia is too little used. If, according to Osler, its good effects are shown (*a*) in the lessening of delirium, tremor and toxic features, (*b*) in the increased elimination of toxin by the kidney, (*c*) in the falling of the heart-rate; in the lessening of vasomotor paresis, it would seem the ideal sane treatment, especially as it does away with problematical hoped-for effects of powerful or uncertain drugs. Unfortunately in a large service

and under conditions which would require the removing of the patient to a specially-prepared room for each treatment hydrotherapy cannot be applied in most hospitals coincidentally with the open-air treatment, and I can give no real number of cases treated by this method.

Injection of normal salt solution, intravenously, hypodermically, or by the bowel: However used, it is probable that the injection of normal salt solution exerts its effect largely in diluting the toxins which are playing upon the nerve-centres and the heart's pacemaker. Increased elimination and diuresis are probably the real effects that we see. "Isotonic salt solutions, .6 to .9 per cent., are often administered when the body has lost much fluid, as they are rapidly absorbed and are devoid of irritant action. Thus in hemorrhage these solutions are injected subcutaneously, intravenously, or per rectum. A rapid improvement in the circulation follows, and this has given rise to the erroneous opinion that such saline infusions stimulate the heart directly as well as by the mechanical effect of the increase in the fluids in the body. This theory has led to infusions being made in weakness of the heart from other causes than hemorrhage." "There is still some question as to whether the infusion of salt solution is really remedial in loss of blood" (*Feis*) (*Cushny*). His results indicate that the injection of large quantities of salt solution is by no means the harmless proceeding which it is generally supposed to be" (*Cushny*). The effects upon the heart which might be ascribed to the use of salt solution given in its various ways are charted in the section "Principles of Treatment—Elimination."

Bleeding.—Bleeding would more properly be called a reliever of the heart than a cardiac stimulant. Its proper application is a question of much delicacy." To bleed at the very outset in robust, healthy individuals in whom the disease sets in with great intensity and high fever is, I believe, a good practice." "Late in the course marked dilatation of the right heart is the common indication" (*Osler*). "Bleeding is best in the second stage when heart-failure is impending" (*Tyson*).

"Distended jugulars, marked accentuation of the second sound, pulse small and soft, moist râles appearing in the lungs, are the indications for bleeding" (*N. S. Davis*).

Cyanosis is frequently the one condition present when bleeding is ordered. Cyanosis by itself may be a superficial vasomotor toxic reac-

tion by no means dependent on a dilating right heart and frequently relieved when the patient is put to rest or put in the open-air ward. It by no means always calls for bleeding. Very few, perhaps too few, cases were bled in this winter's series.

- B. 94 years, non-alcoholic. Illness began on 2/22 with chill. In spite of his age illness lasted five days until 2/27.

	Tempera- ture	Pulse	Respira- tion.	Blood- pressure
2/22.....	103	80	35	120
2/26.....	103	80	40	120
2/27.....	104	140	60	

Bled late on this date. Cyanosis, edema of lungs, distended jugulars appearing. Very delirious. 10 ounces removed. Absolutely no effect on temperature, pulse, respiration, or general condition. Bled late.

- K. 50 years, alcoholic (?). 4/21. Chilled two days ago. Admitted cyanosed and in distress. Bleeding was ordered, but improvement on patient's being put to bed was so marked that it was never performed. Crisis took place next day. Total duration of illness three days.

	Tempera- ture	Pulse	Respira- tion	
4/21.....	102	120	35	
4/22.....	99	120	35	} Crisis.
	98 ⁴	120	25	

- P. 45 years, non-alcoholic. From 11/23 to 11/30 very ill and delirious. On 12/4, four days after his crisis, sudden drop of temperature from 98⁴ to 96, pulse 100 to 70, respiration 50 to 30. (Respiration had never dropped with temperature.)

Patient sweating, cold, pallid, collapsed, but not blue. Pulse not markedly bad. Was bled 18 ounces and given an intravenous injection of normal NaCl. In spite of a depletion at a time when stimulation would seem indicated patient recovered. Bled late.

- E. 44 years, alcoholic. Case of relapse. Admitted 1/25 on the third or fourth day of illness. Very delirious. Cyanosed, but note says no suggestion of cardiac dilatation and pulse was good. No distention of jugulars. Pulmonic second accentuated. Bled 18 ounces on admission, resulting in marked improvement in the next hour. Cyanosis lessened, delirium increased. Recovery by crisis upon 1/31. Bled early.

- F. 65 years, non-alcoholic. Admitted 2/28. Ill for two days.

	Tempera- ture	Pulse	Respira- tion	Blood- pressure
2/28.....	102	100	30	
3/1.....	98	70	20	
3/2.....	98 ⁴	80	30	
3/3.....	100	130	45	150
	102	120	40	

Sudden rise of temperature, pulse, and respiration on the night of 3/2. Sudden onset of distress and cyanosis at night. Bled 16 ounces. Any condition which calls for bleeding was evidently relieved, for patient recovered quickly and no perceptible signs of weakness of heart or increase in lung condition could be made out next day. Slight fever, increased pulse-rate and respiratory rate lasted for several days. Complete recovery. Bled late.

B's 94 years handicapped any treatment.

F, according to the house surgeon, was quickly relieved of his distress and cyanosis, possibly symptoms of an acute late cardiac weakness.

In K, had bleeding been performed it certainly would have been given credit for relief of symptoms.

In E, bleeding early probably was instrumental in bringing about the improvement. Exposure to the cold air and rest in bed might have produced the same result.

Of P it may be said that he recovered in spite of bleeding.

VI. The Principles of the Treatment Directed to the Maintaining of the Blood-pressure.

Since death in pneumonia so frequently comes through paralysis of the vasomotor centre and lowered blood-pressure it is felt that active measures to release the centres from this paralysis should be carried out. Failing in this, measures to constrict the surface and other blood-vessels by direct action must be taken. Various drugs and cold applications briefly outline the principles.

Strychnine, digitalis, caffeine, are all given routinely as supposedly being at least safe persistent upholders of the blood-pressure. The figures of pulse and blood-pressure under continuous administration of these drugs can be referred to under the preceding section. One can certainly say that in no case is *positive increase* of the blood-pressure shown after persistent administration of any one of these drugs.

Cocaine, adrenalin, pituitrin, and camphor are all urged as more powerful restorers of a blood-pressure falling as a result of increased action of toxins upon the vasomotor centre. The results with cocaine have been given and blood-pressure figures included in section 5. Adrenalin and pituitrin were given in the following cases with the following results:

- C. 34 years, non-alcoholic. Second day of illness. Involvement of left base. Adrenalin chloride $\text{m} \times$ of 1-1000 solution hypodermically q. 2 h.

	Tempera- ture	Pulse	Respira- tion	Blood- pressure	
3/17.....	99 ^s	120	30		
3/18.....	96	100	45	...	Death.

Absolutely no appreciable effect could be discerned of either temporary or more persistent keeping up of pulse strength and pulse tension.

- G. 71 years, non-alcoholic. Third day of illness. Involvement of left base. mxx adrenalin plus intravenous injection of NaCl without the slightest perceptible effect in warding off the final failure. . . . Death.
- M. 39 years, alcoholic. Fourteen days of illness. Involvement of right base. Adrenalin solution mxx hypodermically 7 A.M. and 3 P.M.

	Temperature	Pulse	Respiration	Blood-pressure.
3/23.	98 ⁴	90	30	
3/24.	98 ⁴	130	30	
3/25.	98 ⁴	80	25	

Crisis had taken place during the three days of administration. Repeated examination failed to show any variations which might be ascribed to the drug injected. . . . Recovery.

- T. 48 years, non-alcoholic. Fifth day of illness. Involvement of the left base. Adrenalin mxx of 1-1000 solution q. 3 h.

	Temperature	Pulse	Respiration	Blood-pressure
2/13.	101	95	35	112
2/14.	97	60	25	113
2/15.	98 ⁴	70	25	115

Recovery.

The level of blood-pressure in this case was well retained, but, in view of the fact that it was a very favorable case, with crisis occurring at the time of the drug's administration, it is questionable whether the favorable result can be ascribed to the adrenalin.

- T 2. 30 years, alcoholic duration (?). Involvement of right apex. 4/26, adrenalin mxxv of 1-1000 solution. Pituitrin mxxv 1-1000 solution hypodermically every 4 hours.

	Temperature	Pulse	Respiration	Blood-pressure
4/26.	104	120	35	120
4/27.	102	120	40	115
4/29.	102	120	30	115

Pulse noted of good volume and tension on 4/29. Possible development of meningitis. Rapid failure and. . . . Death.
The blood-pressure in this case kept a good level.

There are not sufficient data in these cases to make any conclusions. There is a prevailing impression that neither of these drugs may be given indiscriminately without being followed by a marked subsequent depression, and neither was generally used in the Philadelphia Hospital cases this winter.

"The action of adrenalin injected intravenously is of very short duration."

"Injected hypodermically it causes local ischæmia, but no further effect except in enormous doses. In particular, the blood-pressure is seldom increased by this method of administration."

"The arterial tension is increased by the extract of pituitary body,

but the rise is smaller than that induced by adrenalin, though maintained longer. The heart is slowed, partly through inhibitory action, partly from direct action upon the muscles. The rise in blood-pressure is mainly the result of contraction of the arteries from direct action on them, though the vasomotor centres may also be stimulated in a minor degree" (*Cushny*).

Cocaine.—The results of cocaine on blood-pressure can be consulted in the notes on cocaine in the preceding section.

Cold Applications.—Hydrotherapy in the form of cold sponging or bathing is the form in which cold applications to the body surface should be made. It is discussed above (section 5), and is probably the only reliable continuous method of permanently keeping up the blood-pressure. As mentioned before, it is impossible to apply hydrotherapy in the treatment of the cases undergoing the out-of-door treatment for pneumonia in the Philadelphia Hospital cases.

VII. The Principles of the Treatment Directed to the Relief of Respiratory Embarrassment

The evident respiratory distress leads some to attempt to modify the tachypnoea by the use of methods which may have direct or indirect influence on the respiratory centre. There are apparently four different methods:

(1) A method which endeavors to supply more oxygen to the patient's circulating blood, by which means the respiratory centre's overactivity will be reduced in a natural manner.

(a) Oxygen inhalations.

(b) Cold air and cold surface application, which may deepen inspiration.

(c) Bleeding.

(2) A method which supposedly dilutes circulating poisons and promotes their elimination, or, what is more probable, acts on respiratory centres direct.

 Injections of normal saline solutions.

 Hypodermically

 Intravenously

 By the bowel

with or without bleeding.

(3) A method of treatment of drugs which, in the normal animal or man, reduce the frequency or increase the strength of the respiration. These are caffeine, camphor, strychnine, atropine, and alcohol.

"The pharmacology of the respiratory centre is of considerable interest from the therapeutic point of view, because occasionally one wishes to increase respiration by some stimulant method, and, *while one never, I think, purposely attempts to reduce respiration*, one is met with the fact that, in certain treatments, notably in the treatment of various form of cough, the respiratory centre is depressed" (*Cushny, Proc. Royal Soc.*, April, 1913).

"The action of drugs upon the centre is somewhat more complicated than in most other parts of the central nervous system, because the amount of carbonic acid in the blood is so often altered in them. For example: If a drug slows the respiration, that in itself tends to accumulate carbonic acid in the blood, and the accumulation increases the activity of the centre."

"An ordinary depressant drug has a complicated action. It lessens the twitching of the limbs or any other movement, and thus reduces the carbonic acid tension and so tends to lessen the activity of the centre directly."

(4) An indirect method which, by the relief of restlessness, active delirium, and pain, promotes quiet, which in itself is the most natural way of reducing the frequency of the respiration. This method, of course, is partly considered in the open-air and hydrotherapeutic methods of treatment. One adds to it the careful use of hypnotics or narcotics and well-applied local treatment, preferably strapping of the chest. The relief of pleural pain is followed by instant reduction in the number of respirations per minute.

(a) *Oxygen Inhalations*.—Used as a last resort with the centres paralyzed and a failing pulse, oxygen has been proved no specific. There are enthusiastic reports of its benefit when given early and combined with intravenous injections of normal salt solutions (C. A. Penrose). Many claim that it is irritatingly harmful. Gilman Thompson was a great advocate of its use in pneumonia. In none of our cases was oxygen used till near the termination. No real results were ever seen; temporary relief of the cyanosis was usually obtained.

(b) Cold air and cold surface applications, which act by deepen-

ing the respiration and by keeping up the blood-pressure, improve the circulation in the centres. Convinced as we might be that exposure to the open-air treatment materially influences the respiration, its prompt application prevents comparison of respiratory rate while in an enclosed ward or room with respiratory rate while in the open: the lessening of the delirious activity evidently, from Cushny's statement, must play a large part. Cases carefully observed in the early days, first indoors, then out, would be the only good comparison. Such cases, however, are not many. The records of three are given. Respiratory rate for two or more days, and so taken as not to include the crisis, is given for the 15 cases treated indoors. The respiratory rate of 15 consecutive cases in the outdoor group is given for comparison. The indoor cases occur usually in the warm September and October days. The open-air cases all belong to the cooler days from late October on. The average respiratory rate per minute of the indoor cases is 46.7; for the open-air group of cases, 35.4.

Of three cases whose treatment for several days began indoors and was continued to or changed to the open-air method:

D. Showed no change.

Resp. rate		
30	11/28	Indoors.
30	11/29	Moved.
30	12/4	Open air. Recovery.

G. Showed a steadily rising respiratory rate, as 3 lobes were consecutively involved, and a normal confinement took place.

30	2/26	Onset indoors.
40	2/27	Confinement indoors. Moved.
60	3/1	Out of doors. Slow, gradual improvement. Recovery.

R. Showed no change, probable septicæmia, with arthritis at onset. Development of pneumonia in the ward. Progressive involvement. Relapse and death.

30	2/1	Indoors.
35	2/14	Moved.
30	2/28 to 3/26	In open air. Death.

Sponging, Cold Applications.—Not enough cases were treated by sponging to give any fair test of the method's value in reducing respiratory rate or increasing its depth or relieving respiratory distress.

Bleeding.—Bleeding probably helps respiration by promoting a better flow of blood to the lungs,—i.e., relieving the embarrassment of the right heart and relieving the acute early congestion of the lungs, which seem more productive of distress than is the later complete consolidation. Dietl, in his extensive protest against bleeding, in 1847, states that temporary relief almost always occurs. The early dyspnoea in vigorous cases may always safely be treated by a small venesection of 10 to 18 ounces. The respiratory rate in the cases which were bled was as follows:

- (1) Bled late. Respiration 60 before, 60 after. No change.
- (2) Bled late in postcritical collapse. Respiration 30 before, 30 after. No change.
- (3) Bled early. Respiration 45 before, 35 after. Distinct relief.
- (4) Bled late in a sudden onset of dyspnoea. Respiration 40 before, 40 after. Distinct relief without change in rate.

TREATMENT BY DRUGS

Strychnine, camphor, alcohol, caffeine, have all been discussed and figures of respiratory rate have been given in preceding sections. The figures for strychnine are rearranged and given again, since by many strychnine is considered a very efficient modifier of the respiration. Respiratory depth cannot be spoken, for, unfortunately, it would be to increase the *depth* of respiration that most respiratory stimulants would be given. "Strychnine is used as a respiratory stimulant in some forms of pulmonary disease in which it is desirable to increase the respiration or provoke coughing" (*Cushny*). "The respiration is quickened and deepened by small quantities of strychnine" (*Cushny*). Against all drugs given for their effect upon respiration must be urged:

(1) That they are of necessity handicapped by having an already poisoned centre to work upon.

(2) That the muscular activity and restlessness which they may produce will in itself increase the CO_2 tension in the blood, and, as a natural result, increased respiratory rate, quite apart from any action by the drug, will ensue. Continuous administration of strychnine in several cases this winter gave results as follows:

a.	Grain $\frac{1}{80}$ q. 3 h.	for 13 days.	Respiration 35 to 25.	Crisis.	—
b.	Grain $\frac{1}{80}$ q. 3 h.	for 8 days.	Respiration 35 to 30.	....	+
c.	Grain $\frac{1}{80}$ q. 3 h.	for 3 days.	Respiration 40 to 30.	Crisis.	—
d.	Grain $\frac{1}{80}$ t. i. d.	for 2 days.	Respiration 30 to 50.	....	+
e.	Grain $\frac{1}{80}$ q. 3 h.	for 2 days.	Respiration 40 to 60.	....	+
f.	Grain $\frac{1}{80}$ q. 3 h.	for 10 days.	Respiration 45 to 25.	Crisis.	—
g.	Grain $\frac{1}{80}$ q. 3 h.	for 6 days.	Respiration 60 to 25.	Crisis.	—
h.	Grain $\frac{1}{80}$ t. i. d.	for 4 days.	Respiration 45 to 40.	....	—
i.	Grain $\frac{1}{80}$ q. 4 h. hypodermically	for 3 days.	Respiration 30 to 40.	....	+
j.	Grain $\frac{1}{80}$ q. 3 h. hypodermically	for 3 days.	Respiration 30 to 40.	....	+
k.	Grain $\frac{1}{80}$ t. i. d. hypodermically	for 7 days.	Respiration 40 to 50.	....	+
l.	Grain $\frac{1}{80}$ q. 4 h. hypodermically	for 7 days.	Respiration 40 to 40.	....	?
m.	Grain $\frac{1}{80}$ q. 4 h. hypodermically	for 4 days.	Respiration 30 to 50.	....	+
n.	Grain $\frac{1}{80}$ q. 4 h. hypodermically	for 6 days.	Respiration 55 to 35.	....	—
o.	Grain $\frac{1}{80}$ q. 3 h. hypodermically	for 2 days.	Respiration 40 to 60.	....	+

Not much can be deduced from these figures, save that after 13, 10, 6, 5, 3 days of continuous giving of strychnine the respiratory rate dropped with crisis and showed no sign of any subsequent acceleration as a result of the strychnine given.

That after 7-6-4-2 days of administration the respiratory rate remained unchanged or fell slightly.

That in d, e, i, j, k, m, and o respiration was increased in frequency to an extent not wished for by any clinician.

That increased respiratory rate, when seen, was probably due to progressing severe infection and not to any drug given.

Atropine.—"The action of atropine is at first to slow the respiration from some unexplained central action; subsequently the respiration becomes quicker and, according to most observers, deeper, and the amount of air inspired per minute is considerably increased. This is due to stimulation of the respiratory centre" (*Cushny*).

Unless so unusually rapid as to threaten exhaustion by its continuance, rapidity of respiratory rate should be considered as a natural reaction and treated as such; the deficiency of aëration or the toxic stimulus causing the dyspnœa are to be considered, not the responding respiratory centre. If by further continued use of atropine the respiratory were only deepened no objection could be made, but, since acceleration ensues, it would seem that atropine, neither first nor last, is suitable in pneumonia as a respiratory stimulant. If very large doses are given, acceleration of the heart-rate from paralysis of the vagus (now an everyday clinical test) would ensue). The chief result of atropine in continuous treatment is extreme discomfort from the dryness of the mouth and throat. The

effect of continuous administration of atropine may be considered in the accompanying cases.

		Pulse	Respira- tion
B.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. q. 2 h. for 24 hours.	120	50
B 2.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. q. 3 h. for 24 hours.	130+	40—
C.	T. R. belladonna mgv q. 4 h. for 24 hours.	110	40
C 2.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. q. 4 h. for 48 hours.	130+	60—
E.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. q. 3 h. for 48 hours.	120	40
		100—	45+
		140	40
		130—	30—
		100	35
		140+	40+
			Crisis.
G.	Tincture belladonna mgv q. 3 h. for 24 hours.	100	25
		110	25
		130+	30+
K.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. q. 3 h. for 24 hours.	120	35
		90—	25—
L.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. q. 4 h. for 48 hours.	130	40
		120—	40 ?
M.	Atropine sulphate hypodermically $\frac{1}{75}$ gr. 1 dose; no effect noted on pulse or respiration	120	45
		120	45
M 2.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. q. 4 h. for 96 hours.	110	40 ?
		110	40 ?
M 3.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. q. 4 h. for 24 hours.	100	35
		130+	45+
	90 and	130	Crisis.
M 4.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. q. 4 h. for 48 hours.	130	30
		96	30
		110—	30 ?
			Crisis.
N.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. q. 3 h. for 24 hours.	100	40
P.	Atropine sulphate hypodermically $\frac{1}{50}$ gr. 1 dose; no effect noted on pulse or respiration	110	60
		110	60
		120+	35—
S.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. q. 3 h. for 24 hours.	150	60
		140—	60 ?
S 2.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. t. i. d. for 48 hours.	120	40 ?
		120	40 ?
S 3.	Tincture belladonna mgxx t. i. d. for 48 hours.	90	40
		130+	40 ?
S 4.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. for 48 hours.	96	30
		80—	30 ?
W.	Extract belladonna $\frac{1}{4}$ gr. t. i. d. for 48 hours.	120 ?	40 ?
		120	40
T.	Atropine sulphate hypodermically $\frac{1}{150}$ gr. q. 4 h. for 5 days.	110	30
		120+	55+
W 2.	Atropine sulphate $\frac{1}{150}$ gr. hypodermically every 4 hours	80	40
	every 48 hours	50	20
		140+	60+

7

It is to be noted that in M and P $\frac{1}{75}$ gr. and $\frac{1}{50}$ gr. were given hypodermically with no noticeable effect on pulse or respiration, which remained at 120 and 45 and 120 and 60; that in several cases (7) no change in the rate of respiration at least was seen after 48,

48, 48, 48, 48, 48, and 24 hours respectively of hypodermic administration of atropine; that in the remaining cases increases or decreases of 5 or 10 per minute in the respiratory rate seem about equally divided; that the cases in which acceleration was most marked died (it is very doubtful if the atropine had any relation to the acceleration); that the case K, showing the most distinct relief and drop of 10 in the respiratory rate, had his crisis during the 24 hours of administration; that C, showing also a drop of 10 in his respiratory rate, died; that the pulse showed no constant changes during the atropine's administration, showing slight rises and falls, and was always able to drop with the crises, even if the crisis followed close upon an atropine injection.

VIII. The Principles of Treatment Directed to the Reducing of the Temperature.

While admitting that fever is a necessary reaction in infection, many clinicians rightly claim that its continued presence is damaging to the nervous system and exhausting to the body, and believe that the taking away of heat by conduction and radiation, as in the open-air treatment, or by sponging, immersion and cold applications (hydrotherapy), is beneficial, is followed frequently, as well, by relief of nervous symptoms, and is, moreover, a vascular and cardiac stimulant. By others, various drugs which lower temperature in various ways are used. The reduction of temperature by open-air treatment and by hydrotherapeutic measures can be objected to on rational grounds. The added benefits of the method have been described elsewhere in various sections. Some detailing will be given here.

On the surface it might be a hard matter to prove that open-air treatment possesses the antipyretic effect ascribed to it. The 15 indoor cases previously referred to had a mean fever level in their first two days of exactly 102. The outdoor cases had for the same period of time a mean level of 102 and a fraction. A large percentage of the indoor cases, however, were fatal cases with little or no febrile reaction. A striking difference is seen when the course of the temperature is compared. In no one of the 15 indoor cases does a drop of temperature take place in the 24 to 48 hours subsequent to admis-

sion. In 33 of the cases on the bridge a fall of one or two degrees takes place in the same time. This fall in these cases is quite apart from, and well removed from, the crisis. It has no connection with the many sudden unexplained drops seen in many other cases; such have been carefully ruled out. It has no connection with the mild collapse frequently seen in severe pneumonias coming to a hospital and which is brought on by exertion, for in these the temperature variation is from subnormal or low temperatures upward; it represents a real drop in temperature from a level not reached again in the course of the disease. Many other cases in which crisis or lysis seems near enough to be given credit are not included.

As mentioned in other sections, hydrotherapy is rarely used in the open-air cases at the Philadelphia Hospital. It is much to be regretted, for its beneficial effect in reducing temperatures is beyond question.

The reduction of temperature by drugs is still attempted by some in pneumonia. Quinine, guaiacol and salicylates are mainly used. Quinine, since still a specific action is claimed for it, is considered in the section on chemotherapeutical treatment. The action of guaiacol, a constituent of wood tar, is thus described by Cushny: "Applied to the skin over a sufficiently wide area, guaiacol produced a marked fall in temperature in fever. The explanation is that a certain proportion is absorbed from the skin, and the fall of temperature is one of the symptoms of poison. The fall of temperature is generally abrupt, is accompanied by some exhaustion and weakness and by profuse perspiration. The temperature soon rises with shivering and rigors, and there seems good reason why guaiacol should not be considered among the more satisfactory antipyretics." Guaiacol was used in the following cases:

B. Non-alcoholic, 43 years, left apex involved, ill for 10 days. Guaiacol gr. x t. i. d. by mouth.

	Temperature	Pulse	Respiration
3/23.....	101	100	30
3/24.....	{ 99 98 ⁴	80	30

Crisis occurring on 11th day prevents any conclusion as to the drug's action. No sweating, no weakness.

B 2. Non-alcoholic, 38 years, left apex involved, 6 days' illness. Guaiacol gr. x 3 times a day by mouth.

	Temperature	Pulse	Respiration
3/6	102	110	40
3/6	104	130	50
3/7	104	130	60

Absolutely no effect noticed as result of guaiacol; temperature unaffected; no symptoms suggestive of guaiacol absorption.

C. Non-alcoholic, 30 years, left apex involved, 6 days' illness. Guaiacol gr. iv q. 3 h.

	Temperature	Pulse	Respiration
5/19	101	90	30
5/19	102	100	30
5/20	99		
5/20	100	90	30
5/21	99		
	100	80	30
	98		
5/22	98 ⁴	60	30
5/23	97	60	20
5/24	98	60	20
5/25	97	60	20
5/26	100	70	20

One hundred and twenty-eight grains taken; a mild case; guaiacol may have produced irregular temperature; the patient complained of drenching sweats for several nights during administration. Guaiacol did not prevent a recurrence of slight fever beginning on 5/26 and lasting for ten days, due to an accumulation of fluid in the chest.

C 1. 20 years, non-alcoholic; sick for 7 days; left apex involved; guaiacol gr. x 3 times a day.

	Temperature	Pulse	Respiration
3/1	104	120	65
3/2	102	130	65
3/3	99	130	60
3/4	99 ²	100	40
3/5	98 ⁴	90	25
	98 ⁴	80	25

Crisis

Guaiacol from 3/2 to 3/8; no evident effect, either in bringing down temperature or respiratory rate, or in producing signs of guaiacol's absorption. 180 grains taken.

L. Ill for 2 days; 45 years; right upper lobe, right lower lobe. Guaiacol gr. v t. i. d.

	Temperature	Pulse	Respiration
4/6	102	105	30
4/7	104	110	40
4/8	101	130	50
4/9	100	102	45
4/10	102	140	35
4/11	102	130	35
	99	100	25

An irregular temperature, with remaining high; an irregular pulse with eventual crisis; no effect of drug could be noted.

L 1. 20 years; left apex. Ill for 2 weeks. Guaiacol gr. x 3 times a day.

	Tempera- ture	Pulse	Respira- tion
2/22.....	101	140	45
2/23.....	101	130	40
2/24.....	97 ⁴	120	40
2/25.....	98 ⁴	120	40
2/26.....	99 ⁴	120	40
2/27.....	101	110	40
3/3.....	102	100	30

Guaiacol probably did not cause critical drop. It did not prevent recurrence of fever and eventual occurrence of tuberculosis. T. B. transferred.

T. 43 years, ill for 5 days; right apex. Guaiacol gr. x t. i. d.

	Tempera- ture	Pulse	Respira- tion
2/15.....	104	110	35
	103	110	35
2/17.....	102	110	30
2/19.....	105	120	55
2/20.....	105	120	55

No effect of drug. Steady rise of temperature. Death.

W. 20 years, ill for 6 days; right upper and lower. Guaiacol carbonate gr. x t. i. d.

	Tempera- ture	Pulse	Respira- tion
3/10.....	100	110	50
	100	120	50
3/11.....	102		
	103		
3/12.....	100	120	40
3/13.....	100	130	45
3/14.....	100	120	40
	98 ⁴	100	30

A severe case, marked variations, persistent vomiting, great prostration. No really favorable effects on temperature. Recovered.

L 1. 20 years; left apex; ill for two weeks. Guaiacol gr. x t. i. d.

	Tempera- ture	Pulse	Respira- tion
2/22.....	101	140	45
2/23.....	101	130	40
2/24.....	97 ⁴	120	40
2/25.....	98 ⁴	120	40
2/26.....	99	120	40
2/27.....	101	110	40
3/3.....	102	100	30

Guaiacol probably did not cause critical drop. It did not prevent recurrence of fever and eventual occurrence of tuberculosis. Tuberculosis transferred.

T. 43 years. Ill for five days; right apex. Guaiacol gr. x q. 4 h.

	Temperature	Pulse	Respiration
2/15	104	110	35
	103	110	35
2/17	102	110	30
2/19	105	120	55
2/20	105	120	55

No effect of the drug. Steady rise of temperature. Death.

W. 20 years. Ill for six days, right upper and lower. Guaiacol carbonate gr. x t. i. d.

	Temperature	Pulse	Respiration
3/10	100	110	50
	100	120	50
3/11	102		
	103		
3/12	100	120	40
3/13	101	130	45
3/14	100	120	40
	98 ^d	100	30

A severe case, marked variations in temperature, persisting vomiting, great prostration, no sweats, no real effect of the drug could be noted.

M. 65 years. Ill for two weeks, left base. Guaiacol carbonate gr. x t. i. d.

	Temperature	Pulse	Respiration
2/25	101	100	40
2/26	101	120	40
2/27	100	130	50

No appreciable effect, temperature never reduced. Death.

M. 59 years. Ill for four days, asthmatic bronchitis, right base involved. Guaiacol, drops x on skin b. d.

	Temperature	Pulse	Respiration
2/17	104	130	30
2/18	103	110	40
2/19	101	110	30
2/20	101	110	40
2/21	102	110	30
2/22	98	90	25

A steady, gradual fall after admission; no marked remission of fever; no sweats; the loud râles in the lungs did not clear up till crisis. Recovered.

N. 51 years. Ill for five days, whole right lung. Guaiacol gr. x t. i. d.

	Temperature	Pulse	Respiration
2/3	97	80	25
2/4	102	100	40
2/5	101	120	35
2/6	101	120	40

An irregularity of heart developed, temperature irregular from the start. No sweats. Sudden death.

P. 40 years, 8 days ill, right base involved. Guaiacol carbonate gr. x t. i. d.

	Tempera- ture	Pulse	Respira- tion
5/8.....	103	120	30
5/9.....	98 ^a	80	20
5/10.....	98	80	20
5/13.....	101	100	25

No real effect of drug; crisis on the 9th day. Irregular fever reoccurring from 5/10 to 5/13. Recovered.

R. 18 years, 6 days ill, left base involved. Guaiacol gr. x t. i. d.

	Tempera- ture	Pulse	Respira- tion
3/7.....	{ 102	120	40
	{ 104	130	40
3/8.....	97	92	35
3/9.....	98	90	35

No real effect of drug. Crisis was due and occurred on seventh day. Recovered.

Y. 63 years. Ill for five days, right apex and lower lobe. Guaiacol carbonate gr. x t. i. d.

	Tempera- ture	Pulse	Respira- tion
3/20.....	{ 102	120	45
	{ 101	120	45
	{ 99	95	35
3/21.....	99	100	30
3/23.....	98	130	35
3/27.....	98	110	40

Evidently in crisis on admission on the 6th day. The drop of temperature cannot be ascribed to the drug. Recovered.

In no case is any real persistent reduction of fever evident. Irregular temperatures, dropping two or more times in the course of the illness from 103, 102, and 101 to 100, 99, and 98, and resuming the original high level, are seen in cases C, L, L 1, M, N, P, T, W, and Y.

In C prostrating sweats were noted. The pulse-rate rose in P, L, M, N, T, W and Y; did not rise or fall in C, M, M; and rose and became irregular in N.

The respiratory rate and cough were unaffected.

No effect, death or an intervening crisis, is seen in B 1, B 2, C 1, C 2, L 2, M, M, N, P, R, and Y.

In T a gradual fall from 104 to 102 is followed by a rise to 105 and death.

In L 1 tuberculosis developed.

Salicylates.—No longer considered a specific for pneumonia,

though enthusiastically praised for their action as late as 1899, the salicylates are used either to try and reduce the fever in pneumonia or to influence the arthritis occasionally occurring; the acceleration of pulse and respiration and raising of blood-pressure, results ascribed to salicylates, are not, as a rule, sought for.

The following cases were given salicylates with these detailed results:

A. Arthritis of ankles, knees, hips, elbows for 2 weeks; the average

	Temperature	Pulse	Respiration
1/1/13.....	101	110	35
Salicylate of soda gr. xv with bicarbonate of soda. gr. xv q. 3 h. for 4 days, 1/7/13 to 1/10/13, with no effect. On 1/12/13, development of pneumonia.			
1/12/13.....	{ 103	120	40
	{ 102	120	35

Salicylates gr. xv q. 3 h. repeated for 7 days, 1/13 to 1/20. Right lower lobe, left lower lobe, left apex, successively involved while under treatment. Knees, ankles still remain sore and swollen.

	Temperature	Pulse	Respiration
1/13.....	101	120	35
1/15.....	101	120	35
1/19.....	101	120	35
1/21.....	99	115	35

B. 29 years, non-alcoholic, sick for 3 weeks, chill 5 days previous, followed by cough, pain in side and fever. Left base involved.

3/19 salicylate of soda gr. xv 3 times a day.

	Temperature	Pulse	Respiration
6th day, 3/19.....	{ 102	110	30
	{ 99	80	30
3/20.....	{ 103	120	35
	{ 100	120	35
3/21.....	100	120	35

Their regularity in the fever may have been due to salicylates; no other results could be ascribed to the drug. Died.

G. 49 years, non-alcoholic; 3 days ill, chill, pain in side; left base extending to whole lower lobe.

	Temperature	Pulse	Respiration
3rd day, 12/18.....	102	90	25
Salicylate of cinchonidia gr. xv q. 4 h.			
12/19.....	103	100	35
12/20.....	104	110	30
12/21.....	105	120	30
12/22.....	105	140	40
12/23.....	102	140	40

Salicylates powerless to prevent rise of temperature, pulse, respiration or extension of process. Death.

I. 22 years, non-alcoholic, chill 6 days previous to admission; left apex involved.

	Tempera- ture	Pulse	Respira- tion
3/4.....	101	110	30
Salicylate of soda gr. xv q. 3 h.			
3/5.....	101	110	30
3/6.....	101	110	30
3/7.....	98 ⁴	90	20

The crisis was due; no effects can be ascribed to salicylates. Crisis, 9th day.

M. 20 years, ill for 2 weeks with wandering pneumonia; four lobes successively involved; an irregular temperature before 4/8/13 of 100 to 102.

	Tempera- ture	Pulse	Respira- tion
4/8 to 4/27.....	{ 98 101	110 140	40 50

On 4/8, ammonium salicylate gr. v q. 4 h. continued to 4/27. No result apparent in limiting disease's progress; perhaps slight lowering of temperature. Pulse-rate and respiratory rate unaffected; death on 4/27 suddenly.

N. 55 years, alcoholic; ill for 2 weeks; chill at onset; lower left lobe involved.

	Tempera- ture	Pulse	Respira- tion
2/23.....	{ 103 98	90 90	30 30
2/24.....	103	120	50
2/26.....	101	120	40
2/27.....	100	140	50

The salicylate may have reduced temperature; it did not help pulse or respiration. Died.

R. Arthritis for 3 weeks in knees and hips, and salicylate of soda gr. xv, bicarbonate of soda gr. xv q. 4 h. had been given from 1/24 to 2/6/13. No effect on arthritis, and pneumonia developed while under treatment on 2/14. Right base, then left base. Salicylate repeated, gr. xv, q. 2 h. from 2/14 to 2/16. No effect on temperature, pulse or respiration, nor arthritis.

	Tempera- ture	Pulse	Respira- tion
2/14.....	99	100	30
2/15.....	{ 100 100	120 130	35 35
2/19.....	{ 101 99	150 130	35 35

From 2/20 to 3/30, irregular temperature, pulse, and respiration from enormous bedsores. On 3/31 relapse, pneumonia at right apex, delirium and death.

Overlooking these cases, one does not hesitate to say that salicylates did not act as an antipyretic, neither did they influence joint condition; nor did they act as prophylactic in preventing pneumonias developing in certain of the joint cases. They were further powerless to prevent extension of the disease and had no effect upon symptoms in general. No other antipyretic drugs were used.

B

PRINCIPLES UPON WHICH SPECIFIC METHODS OF TREATMENT ARE BASED

*I. The Treatment by Injection of Sera Containing Antibodies—
Passive Immunity.*

Encouraged by the success attending the use of diphtheria antitoxin, it was natural that a serum treatment of such a widespread general infection as pneumonia should be sought. The sera of animals immunized against pneumococci are most frequently used; the serum of patients convalescing from pneumonia has been employed, in the hope that the blood of such patients, after their crisis, would contain abundance of bodies (antibodies) able to neutralize the toxins of pneumonia or act in a bacteriolytic way. So far the results have not been encouraging. Anders's analyses give a good idea of the status of the method of treatment by the injection of antipneumococcus serum up to 1905. Much has been done since then, but collective figures do not show the wished-for results.

The earlier sera were made by repeatedly and intensively injecting nonvirulent pneumococci, the horse being the animal employed. The standardization was uncertain, the action of the sera was not well understood, and it can be unreservedly said that serum treatment was brought into disrepute through our ignorance.

Probably no criticism of the results of serum treatment in the past is valid, because in no case was the serum scientifically administered or given in sufficient doses.

The whole question has been reopened; the older sera produced by a single nonvirulent organism having been discarded. The new sera are made by injecting several of many strains of virulent pneumococci; in the production of Romer's serum three animals—the horse, cow, and sheep—are used and their blood-serum mixed so that the antibodies formed may be in association with the most varied complements. It is insisted that we recognize the difference between an antitoxic serum, such as that of diphtheria, and an antibacterial one, such as the antipneumococcus serum, in which the action to be expected is a varied one, a limiting of the growth or destruction of the infecting organism and a prevention of further extension of the process taking place, as well as neutralization of toxins.

A crisis or lysis in pneumonia takes place when enough antibodies have been formed, and not before. Serum treatment, to be effective, must be early and must consist of such large amounts that the deficiency of antibodies is made up quickly and the crisis hurried forward. Neufeld and Handel urged the intravenous administration of the serum and in large amounts, because, as is easily proved in all experimental work, a fixed maximum dose is required before effects are seen. They and, later, Ungerman affirm that in antibacterial sera the law of multiples does not operate.

.01 Cc. of the antibacterial serum will protect against 10,000 times the fatal dose of virulent pneumococci, but one-fifth of this amount (.002 Cc. of serum) will not protect against one-fifth of 10,000 = 2000 times the fatal dose will not even protect against ten times the fatal dose.

Large, early and repeated intravenous administration constitutes efficient serum treatment. Small, occasional, late hypodermic injections of serum have neither theoretical nor practical value. Beyond a few serum rashes, no ill-effects have been seen.

Thirty to forty cubic centimetres, containing 400 immunizing units, repeated several days in succession, are safely given.

It is still early to make conclusions; the ideal serum has not been reached. Figures dealing with a large group of cases treated under identical circumstances are lacking. A report by Beltz is instructive for two reasons: First, that no case in his series is considered as having been favorably affected by the serum if the serum was given after the third day, since by that time a natural crisis might be on hand; secondly, for the enclosed included table showing the apparent shoving forward of the day of crisis.

In 25 cases not treated by serum, the crisis occurred on the 2d day in 0, 3d day in 0, 4th day in 1, 5th day in 0, 6th day in 1, 7th day in 9, 8th day in 3, 9th day in 3, 10th day in 0, 11th day in 0, 12th day in 0, 13th day in 0, 14th day in 1, lysis in 3, died in 4.

In 25 cases treated with serum, crisis occurred on the 2d day in 1, 3d day in 6, 4th day in 3, 5th day in 2, 6th day in 2, 7th day in 1, 8th day in 0, 9th day in 2, 10th day in 0, 11th day in 0, 12th day in 0, 13th day in 0, 14th day in 0, lysis in 4, died in 4.

Passler, May Dorendorf, Ridder, Weitz, and many others report small series of cases, 153 of which show a death-rate of 12.4 per cent. All agree that general conditions are improved, but it is quite evident

that in several series the death-rate is not materially affected and that complications and extensions of the process are not prevented.

Serum treatment was not used in Philadelphia Hospital cases this winter. In the past years spasmodic treatment had been given, but with no results that are convincing.

II. Treatment by Means of Vaccines—Active Immunity.

It was natural that the success attending the vaccine treatment of various conditions should suggest the employment of the same method in pneumonia. The injecting of killed organisms subcutaneously produces antibodies in the tissues, which may influence an active infection due to the same organisms in living state elsewhere in the body. It is preferred that the organisms to be injected be the descendants of those causing the infection,—i.e., that they be recovered from the body by blood culture or culture from an infected area (“autogenous vaccines”); if this cannot be done, a vaccine composed of a well-known strain of the organism may be used. Since the same appearing infections are often caused by different strains of organisms, differing in various ways as well as in their virulence, certain vaccines are made by combining several of these strains (“polyvalent vaccines”).

The vaccine treatment of pneumonia undoubtedly is handicapped from the start; the crushing rapidity of the initial infection precludes waiting for the growth and preparation of the preferred autogenous vaccine. Nevertheless, many are convinced that good results are obtained by a vigorous vaccine therapy; no real effect can be expected from half-way measures, and Allen advocates the following procedure:

1. Make smears of sputum and cultures of same, or even puncture the lung if need be, to get the real strain of pneumococcus causing the infection.
2. Use immediately 25,000,000 polyvalent stock vaccine.
3. Repeat in 36 to 48 hours if there has been no response. If autogenous vaccine is ready, use it.
4. Give 50,000,000 if there has been no response in 36 or 48 hours.

5. Maintain the dose or increase it every 3 or 4 days.

Further references to the vaccine treatment which seem worthy of consideration may be given: Leary, *Boston Medical and Surgical Journal*, 1909 p. 714; Craig, *Medical Record*, November 18, 1911; Morgan *Proceedings Royal Society*, vol. 3, No. 9; Harris, *British Medical Journal* of June, 1909.

Raw treated by vaccine 207 cases with 34 deaths. No empyemas developed in his cases. Stoner collects 155 cases with a mortality of 12.9 per cent. Robertson treated 20 cases with 3 deaths; Leary 83 cases, largely alcoholic, with 8 deaths. Charteris (*Glasgow Medical Journal*, 1912), using a polyvalent serum, gives the following results in 19 cases:

Case No.	Day of disease	Injection	Day of crisis or lysis	Day of death
1	5	1	6	
2	5	1	..	6
3	4	1	4	
4	3	5	0	Death, empyema, and meningitis.
5	3	1	3	15
6	2	1	2	
7	3	1	3	
8	6	2	..	10
9	3	1	5	
10	2	1	5	
11	6	1	..	9
12	2	5	9	
13	3	1	5-6	
14	3	1	4-6	
15	3	3	9	
16	2	1	empyema	
17	1	2	6,	but death on 12th day.
18	2	1	4	
19	5	1	8	

In four cases, (1, 5, 14, 18) crisis took place in 24 hours after injection and in No. 2 in 48 hours after injection.

When given early, in

Case No. 5, death on 15th day.	Case No. 12, crisis on 8th day.
7, lysis on 5th to 7th day.	16, empyema on 8th day.
9, crisis on 4th to 5th day.	17, crisis on 7th to 8th day.
10, lysis on 4th to 6th day.	18, crisis on 3rd to 4th day.

Cases Nos. 5 and 17 died of exhaustion after crisis.

Case No. 16, complication was seen, empyema.

Cases Nos. 4, 8, 12, 15, 17 the disease spread after the vaccines were used.

Charteris's figures seem to show that there is no consistent reaction to be looked for; but, since in 14 of his 19 cases only one injec-

tion was given, it cannot be said that a treatment conforming to the vaccinist's requirements was pursued.

The vaccines do no harm; if a polyvalent vaccine is used, there is a chance that amongst the pneumococci in it may be the same strain of organism that is causing the infection.

If an autogenous vaccine can be made in time, it is, of course, far more preferable; if a vaccine treatment is carried out at all, it should be vigorous. A failure with a small, incomplete dosage means nothing. Many of us are inclined to look favorably upon the results given by some observers. Vaccines were not used in the Philadelphia Hospital cases.

Combined active and immunity production is seen in the sensitized vaccines of Besredka. Ehrlich and Morganroth noted that every cell (or bacterium), when brought in contact with its specific antibody, fixes it to the exclusion of every other substance which may be present. Besredka uses a living vaccine to absorb the specific antibody from an immune serum. A virulent pneumococcus, for example, might be mixed in its own antipneumococcus serum, left for twelve hours, then separated from the serum, washed and injected; the sensitization lowers the virulence of the organism, yet seems to promote its powers of conferring active immunity.

Experimental tests show that a sensitized vaccine is noticeably more powerful than one not so sensitized. There are but few records as yet of the results of sensitized pneumococcus vaccine in pneumonia. Cohendy and Bertrand (*Compt. Rend. Soc. de Biol.*, March 8, 1913) detail seven cases treated with massive doses of certain strains of *living* pneumococci sensitized with their own particular immune sera. In five cases their statement is that 20 to 40 hours after the first injection the temperature fell from 39 to 40° C. to normal.

The injections were made on the second, third, fourth, or fifth day. Much more important, as showing how intricately specific any form of immunity production may be, are the statements that

(a) From 5 cases pneumococci were isolated that could be agglutinated by some one or other of the sera used in sensitizing the vaccine.

(b) In one fatal case treatment was absolutely negative, and

in this case the pneumococci isolated from the sputum and lung were agglutinated by no immune sera whatever. In one recovered case, presumably responding to treatment, the isolated pneumococcus was not agglutinated by the sera employed in sensitizing. Besredka's vaccines have not, as yet, come into use in this country.

Rosenow has suggested using a vaccine which has been detoxicated by autolyzing or digesting the cocci in NaCl solution. The depressant negative phase seen in vaccine treatments is thus avoided, and the cocci thus treated can be separated and injected in a living state. The remaining NaCl solution is shown to be a toxic depressant; this vaccine would presumably not equal that of Besredka's, which apparently is not only detoxicated, but has added to itself the antibodies of the immune serum with which it has been mixed. Rosenow's reports of cases apparently do not show the hoped-for results; 32 per cent. of his cases are stated to have died in the series recorded.

III. Treatment by Leucocytic Extract.

Treatment by the method advocated by Hanson Hiss, Jr., and Zinsser has not been followed out by other observers. The theory promulgated by these authors is as follows: "Something must be lacking in sera, either a toxin-neutralizing body or, as has been suggested, a complementary body necessary for the activation of the bactericidal or bacteriolytic immune bodies. In experiments *in vitro* complements may, as is well known, be furnished by fresh normal sera of various kinds, but in the body of infected animals and man they must be furnished, if at all, by the plasma or cells." "It is a general idea that the antisera fail because of complement deficiency" (Leary).

The well-known phagocytic action of the leucocytes persuaded Hiss and Zinsser that possibly the leucocytes contained the necessary complement in their own bodies. Extracts were made, in water or other harmless solutions, or the leucocytes were used undissolved and given as a hypodermic injection. In many of their cases apparently good results were obtained, but not more uniformly than by the various sera or vaccine. (Hanson Hiss, Jr., died of pneumonia in New York during the winter of 1913.)

IV. Chemotherapeutic Methods.

In earlier days pneumonia was presumably cured by many drugs, and even in these later days certain preparations have been considered to act specifically upon pneumonia and as even able to abort or cut short the disease. Some of these were veratrum viride, tartar emetic, calomel, carbonate of creosote; the claimed specification of all of these has been completely disproved. Colloidal silver has advocates, particularly in France, though in the many cases I have looked over I see nothing to recommend in its use save that certain cases which were treated by colloidal silver recovered.

The origin of the treatment seems a little vague; several refer to the fact that the good results obtained by Halsted, in his silver-foil dressing of wounds, induced them to believe that a chemical bacteriolytic action is set up by the silver on the skin. Many forms of silver treatment in various other infections are used, and in them all specific results are claimed. It still remains to be proved that silver, as collargol or unguentum Credé, really cures the infection which terminates under its use. No cases were treated in the Philadelphia Hospital this winter with any of the above-mentioned drugs.

Quinine, hydroquinine, and ethyl-cuprein hydrate, the two latter being quinine derivatives, can be grouped. Quinine has many enthusiastic advocates and has been used extensively. A direct action on the infection is claimed, but whether antitoxic or bactericidal is nowhere clearly brought out. Experimentally, quinine has practically no action in preventing infection when introduced into the animal body before or with the infecting pneumococcus culture. Hydroquinine has some slight action and ethyl-cuprein-hydrate has a very distinct one.

It is against all experience that a bacterial affection should be reached by any save specific means, such as serum or vaccine treatment, but since observers such as Morgenroth and Sir Almroth Wright can consider seriously the action of ethyl-cuprein-hydrate, others certainly may be fortified in their belief in quinine. Quinine is quite extensively used still in the treatment of pneumonia, and for it results not short of specific are claimed. The results in the Philadelphia Hospital, which I have tabulated, are as follows:

A. 29 years, non-alcoholic, arthritis for 2 weeks. Pneumonia of right base, left base, left apex on

Date	Temperature	Pulse	Respiration	Blood-pressure	Urine
1/9.....	101	110	35		
1/11.....	102	120	35	...	60 ounces.
Quinine and urea gr. xv intravenously—					
1/12.....	103	130	35		
1/13.....	102	120	35	110	80 ounces.
1/14.....	101	120	35		
1/15.....	101	120	35		
1/18.....	101	120	35		
1/19.....	100	120	35	...	90 ounces.
1/20.....	{ 102	120	35		
	{ 99	115	35		

An ill man with mild delirium. Illness began in the hospital. Quinine and urea followed by aggravation of symptoms. Temperature and pulse rose. Taken out of doors on 1/12/13, which may have been the cause of temperature beginning to fall. Crisis on 11th day. Recovery.

B. 27 years, non-alcoholic. Ill for 3 days; chill, involvement of right upper and lower; heart sounds good.

Date	Temperature	Pulse	Respiration	Blood-pressure	Urine
2/24.....	103	120	40	{ 118 } { 90 }	10 ounces.
White blood-count 24,600. 2/25 quinine and urea intravenously gr. xv, when temperature is 103.					
2/25.....	103	120	40		
2/26 quinine and urea gr. xv intravenously.					
2/26.....	102	120	40		

An ill man; delirious; pulse noted as good on admission. Treatment early. No perceptible effect on temperature, pulse, or respiration that might not have followed from exposure to fresh air on bridge. Failure and death.

C. 24 years, non-alcoholic. Ill for 5 days. Left apex involved. Very hysterical, but in good condition.

Date	Temperature	Pulse	Respiration	Blood-pressure	Urine
5/19.....	102	110	30	...	45 ounces.
Quinine and urea gr. xv hypodermically once daily.					
Quinine and urea gr. vii—					
5/20.....	100	90	30	...	60 ounces.
Quinine and urea gr. vii—					
5/21.....	100	90	30		
Crisis—					
5/22.....	{ 100	90	30		
	{ 98	60	20		

Never an ill man; no delirium, crisis on 9th day. Drop of temperature after quinine and urea, but this time represents the first 24 hours in the open air as well. Recovered.

C. 20 years, non-alcoholic. Sick for 7 days. Chill; delirium; left upper lobe involved.

Date	Temperature	Pulse	Respiration	Blood-pressure	
3/1.....	104	120	65	{ 108 S } { 75 D }	
3/2.....	102	130	60		
3/3.....	102	130	50		
Quinine and urea ordered, gr. xv hypodermically, but crisis began before it could be administered.					
3/4.....	{ 100	110	50		
	{ 98	100	40		
Recovered.					

C. 37 years, complicated with tuberculosis. Sudden onset of delirium 24 hours previously; right apex tuberculous at base consolidation; whether tubercular or pneumococcal not known. A suggestion of crisis would favor pneumococcus infection.

Quinine and urea hypodermically, gr. xv if temperature reaches 102.

	Temperature	Pulse	Respiration	Blood-pressure
1/18.....	103 ^s	140	48	120
1/19.....	101	130	45	120
1/20.....	100	120	40	
1/21.....	98 ^s	130	40	
1/21 to 1/27.....	{ 98 99	120 130	30 35	

An uncertain case and unsuitable for comparison. Temperature began to fall shortly after the dose of quinine and urea, but at this time patient might be temporarily improving from his first 24 hours in the open air. Died.

C. 42 years, alcoholic. Ill for 2 weeks. Chill at onset, but on admission noted to be in good shape. Pulse good volume and tension; right upper and lower lobes involved.

Date	Temperature	Pulse	Respiration	Blood-pressure
1/3.....	104	120	45	
1/4.....	104	120	45	
Quinine and urea gr. xv hypodermically.				
8 P.M.....	103 ^s	120	35	
1/5 2 A.M.....	102 ^s			
8 A.M.....	101	95	30	
11 A.M.....	99 ^s			
1/6.....	98 ^s	80	25	

Striking as the result here may be, it must be remembered that crisis was due. Illness 2 weeks previously had begun with chill. Resolution did not take place for 21 days. Recovered.

F. 20 years, non-alcoholic, onset 7 days ago. Right base involved; persistent hiccough.

Date	Temperature	Pulse	Respiration	Blood-pressure	Urine
3/1.....	104 ^s	120	45	120	
3/2.....	{ 104 101	110	30	120	
Quinine and urea gr. xv hypodermically t. i. d., cocaine gr. ½ t. i. d. hypodermically.					
3/3.....	102	100	40	...	60 ounces.
Crisis—					
3/5.....	99	90	30		
	100	90	30	115	50 ounces.
	99				
	97 98				

Crisis was due and occurred on 9th day; in spite of treatment during 3/2 and 3/3 temperature remained at 102. Irregular temperature preceded. Recovered.

G. 49 years, alcoholic. Delirious illness for 7 days; left base involved.

Date	Temperature	Pulse	Respiration	Blood-pressure	Urine
12/18.....	102	90	25		28 ounces.
Quinine and urea gr. xv hypodermically t. i. d.					
12/19.....	103	100	25		
12/20.....	104	110	30		
12/21.....	105	100	30		
12/23.....	102	140	40		

Progressive extension of lesion. Rise of temperature, pulse and respiration in spite of hypodermic administration for five days. Death.

I. 22 years, non-alcoholic; onset 9 days ago. Left upper lobe, a mild case.

	Tempera- ture	Pulse	Respira- tion	Blood- pressure
3/6.....	101	110	30	
Quinine and urea gr. xv hypodermically, 8 P.M.				
3/7.....	98	90	30	110
3/8.....	98 ^a	90	20	

Striking as this case may seem, crisis was due, occurring on 9th-10th day. Recovered.

K. 33 years, alcoholic. Chill 3 weeks ago, very ill. Since then, delirious last 3 to 4 days. Right upper lobe involved.

	Tempera- ture	Pulse	Respira- tion	Blood- pressure
1/11.....	103	110	45	
Quinine and urea gr. xv hypodermically, when temperature reaches 102.				
5 P.M.....	102	115	60	118
8 P.M.....	101	110	55	
A lysis has already begun on 1/11. Lysis or crisis was long since due. Recovered.				
1/12.....	100	120	50	
1/13.....	101	120	40	
1/14.....	98 ^a	90	30	104

L. 45 years, non-alcoholic. Onset 2 days ago. Chill right upper and lower. Delirious.

Date	Tempera- ture	Pulse	Respira- tion	Blood- pressure	Urine
4/5.....	102	105	30	130 80	36 ounces.
4/6.....	102	110	30		
4/7.....	104	104	50	120 65	
Quinine and urea gr. vii b. d. if temperature reaches 101.					
4/8.....	101	120	40		
4/9.....	100	130	40		
4/10.....	102	120	35		
5 P.M.....	102	130	35		
4/11—					
5 P.M.....	99	100	25		
4/12.....	98 ^a	100	25		

A continued administration of quinine and urea did not bring disease to a close before the 9th day. No real effect on temperature. Lysis. Recovered.

L. 26 years, non-alcoholic. Acute onset 7 days ago. Ailing for 2 weeks previously.

Date	Tempera- ture	Pulse	Respira- tion	Blood- pressure
2/21.....	103	130	40	
2/22.....	101	140	45	
Quinine and urea gr. vii hypodermically t. i. d. if temperature 101.				
8 P.M. 2/23.....	101	130	40	
8 A.M. 2/24.....	97 ^a	120	40	
A marked evident result, but crisis was due, occurring on 9th day. Tuberculosis. Recovered.				
3/3.....	{ 100 102	{ 120 100	{ 30 30	

M. 55 years, non-alcoholic. Onset 2 weeks ago; left lower lobe involved, delirious.

Date	Temperature	Pulse	Respiration	Blood-pressure
2/22.....	100	120	30	
2/23.....	103	90	30	
2/24.....	103	120	50	
2/25.....	101	130	30	

Quinine and urea gr. xv hypodermically t. i. d. when temperature 101.

2/26.....	101	120	40	
2/27.....	100	140	50	

A very ill man. Delirium cleared on 2/27, but death ensued. No real effect on temperature. Marked drops occurred before quinine and urea was given. Death.

M. 59 years, alcoholic. Onset 4 days ago, right base involved, not delirious, asthma. Pulse noted good.

Date	Temperature	Pulse	Respiration	Blood-pressure
2/17.....	104	130	35	

Quinine and urea hypodermically gr. vii b. d. when temperature is 101.

2/18.....	103	110	40	
2/19.....	101	110	30	
2/20.....	101	110	40	
2/21.....	101	120	40	

Steady administration of drug from 2/17 to 2/22; temperature dropped when put to rest in open air. Crisis not hastened, occurring on 8th day. Recovered.

Crisis 2/22.....	102	120	30	
	100	100	30	
	98	90	25	
Postcritical rise 2/23.	100			
	100	80	30	
	98			

N. 51 years, non-alcoholic. Onset 5 days ago, right base involved. Very ill and weak.

Date	Temperature	Pulse	Respiration	Blood-pressure
2/3.....	97	80	25	
2/4.....	102	100	40	

Quinine-sulphate gr. vii hypodermically b. d.

2/5.....	101	120	35	{ 112 65
	98	100	30	
2/6.....	101	120	40	

An irregularity of heart developed in form of frequent extrasystoles. Crisis probably took place on 7th day, 24-36 hours after quinine was given. Sudden failure. Death.

R. 56 years, developed in hospital 24 hours previously. Left base involved.

Date	Temperature	Pulse	Respiration	Blood-pressure
1/8.....	102	120	30	
	100	100	30	

Quinine and urea hypodermically gr. xv.

1/9.....	103	130	50	144
	103	116	50	

q. 3 h. if temperature is 103.

1/10.....	102	140	60	145
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No real effect to be seen. Temperature remained high. Death.

S. 26 years, Onset 5 days ago. Right base involved. Good pulse.

Date	Temperature	Pulse	Respiration	Blood-pressure
3/20.....	103	120	45	115
Quinine and urea gr. xv hypodermically, if temperature is 101.				
2 A.M. 3/21.....	101 ⁴	115	40	
5 A.M.....	98 ⁴	85	30	
8 A.M.....	101	110	30	130
3/22.....	98 ⁴	80	35	

An apparent result of quinine and urea, but crisis was due, and occurred 7-8th day. Recovered.

T. 45 years, non-alcoholic. Onset 5 days ago. Right upper lobe involved.

Date	Temperature	Pulse	Respiration	Blood-pressure
2/15.....	104	100	30	{ 120 90
Quinine and urea hypodermically gr. vii ss b. d.				
2/16.....	{ 103	110	35	
	{ 103	120	30	
2/17.....	102	100	30	
2/18.....	102	100	30	
2/19.....	105	120	55	
2/22.....	105	120	55	

A severe infection. Treatment absolutely without effect. Death.

T. 25 years. Onset (?). Right upper lobe. Very ill. Delirious, in convulsions. In hospital for three days.

Date	Temperature	Pulse	Respiration	Blood-pressure
3/26.....	104	120	35	
Quinine and urea gr. xv hypodermically, if temperature is 101.				
3/27.....	{ 102	140	40	
	{ 102	120	40	
3/28.....	102	130	30	
3/29.....	{ 102 ⁴	120	30	
	{ 99			

Three days of treatment do not avail to reduce temperature below 102. The preliminary drops of 104-102 can not be disassociated with patient's appearing in open air. Died.

Whether or not quinine acts as a specific in pneumonia will be left for the reader to decide. I have endeavored to detail the cases carefully, and have tried to separate an improvement due to crisis or lysis from possible results of the drug treatment. No cases are included in which death followed too quickly after the injections, nor which seemed hopeless when treatment was begun.

In all 19 cases were treated with quinine and urea for a reasonable time and under reasonable circumstances; 8 of these 19 died. Two of the cases which recovered were so mild that no special treatment was at any time indicated.

Hydroquinine is not used save in the treatment of experimental pneumococcus infections.

Ethyl-cuprein-hydrate.—The striking experimental effect of ethyl-cuprein-hydrate on experimental pneumococcus infections, both as a prophylactic measure and as a curative agent, aroused great hopes. Fraenkel in Berlin and Sir Almroth Wright in South Africa experimented extensively with the drug in acute pneumonias. Positive curative results in the human being fell far short of the results found in animal experiments. Poisonous results were too many to allow the drug to be continued in use.

It is impossible to say that a specific drug treatment will not be obtained, and Fraenkel seems to feel that a drug, rather than a serum, will be the ultimate mode of treatment in pneumonia.

Experiments are still being carried on, for all observers feel that the action of ethyl-cuprein-hydrate on the pneumococci is too powerful to be lightly cast aside.

The complications of pneumonia and their treatment will not be touched upon in this paper, nor will a routine of treatment be laid down. As stated in the beginning, this discussion on the treatment of pneumonia was to concern itself only with "What was done, and why, and with what results," in a group of cases which could be carefully followed, in the hope that perhaps some slight clearing of our still rather cloudy therapy in pneumonia might be given.

THE DIAGNOSIS AND TREATMENT OF GASTRIC AND DUODENAL ULCERS

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A CRITICAL study of the recent literature of this subject is most interesting and suggestive. It shows that all medical men, surgeons as well as physicians, until within the last five or six years, were ignorant of much of that is now known concerning peptic ulcers, especially duodenal ulcers. It shows also that it is particularly to English and American surgeons that we are chiefly indebted for our new knowledge, though the great amount of work done with the X-ray has contributed largely to it. Several Continental authorities have lately been frankly awarding this credit to our surgical *confrères* in the two English-speaking nations, particularly to Moynihan in England and the Mayo brothers in the United States, whose writings on peptic ulcer have been especially valuable, based as they have been on actual dissections of the regions involved. By their operations upon some thousands of abdomens during life they have settled numerous doubtful points, regarding what was before comparatively a *terra incognita*.

Some of the ablest operators now admit that in the earlier laparotomies for perforations into the abdominal cavity the disease was generally diagnosed as rupture of an appendiceal abscess, even in many cases in which there really had been rupture of a duodenal ulcer. The actual condition had not been recognized after opening the belly any more than before.

Codman,¹ in a paper written four years ago, said that until shortly before 1909 perforated cases were usually diagnosed as from appendicitis, but in the five preceding years he had found one in sixteen of the acute perforations to have resulted from duodenal ulcer, while during the same five years the other seventeen Boston surgeons had reported twelve only of the perforated cases,—out of a total of 1130

which had been attributed to appendicitis or to its results,—to have been from duodenal ulcer,—that is, one in 94. Codman also asserts that before Weir's illuminating paper appeared in 1900 all surgeons were operating on duodenal cases, supposing them to be appendiceal, as Moynihan ² and others have admitted.

It has been established by the recent numerous dissections during life performed because of perforation, serious hemorrhage, or stenosis that many, possibly a majority, of our supposed cases of hyperchlorhydria were actually duodenal ulcers, the most marked and frequent symptoms in both being pain in or near the epigastrium coming on several hours after eating and, so far at least as concerns the earlier and more active stages of ulcer, an excess of hydrochloric acid in the gastric contents.

The most striking feature in the great mass of statistics concerning peptic ulcers which has accumulated in the last six years is the marked diversity of the figures showing the relative proportions of all such cases in the two sexes and the ratio of duodenal to gastric ulcers. Reports of many thousands of cases, gleaned in the past mainly from European sources, seemed to indicate that till within a comparatively recent date gastric ulcer was most common in women, and duodenal ulcer comparatively rare in both sexes. In the large series of cases recently reported in this country, so far as I have seen, a decided majority of peptic ulcers have been in men. The statistics from the Continent of Europe and the earlier reports from England show generally an excess of gastric ulcers in women, though nearly all the later reports from the various countries agree in showing that a majority of duodenal ulcers occur in men.

Kehr,³ of Germany, between 1904 and 1912 operated upon 954 cases for cholelithiasis, and found duodenal ulcer 29 times in 94 operations that involved the duodenum. Only three of the 29 were in women, while only one of 16 operations for gastric ulcer was in a male. N. Paus⁴ in reviewing 3000 necropsies found three times as many men as women victims of duodenal ulcer. Ewald⁵ in his own experience has seen four times as many men as women suffering from duodenal ulcer. The Mayo brothers⁶ report over 1000 cases of gastric and duodenal ulcer, three-fourths of them in men, and of Friedenwald's⁷ 1000 cases 676 were in men. F. Smithies,⁸ of Rochester, Minn., in reporting 140 operations for gastric ulcer, states that males are affected three times as often as females.

As regards the ratio of duodenal to gastric ulcer the differences are still more remarkable. Perry and Shaw⁹ in 1894 reported 0.4 per cent. of duodenal ulcers in 17,602 sections; Krug,¹⁰ 53 duodenal ulcers in 12,020 sections, and Gruenfeld four in 1150 patients cited by Kemp,¹¹ of Copenhagen. Of the Mayos' cases 64.5 per cent. were duodenal, as were over half of Friedenwald's and a majority of Moynihan's.¹²

Manifestly, in many of the bodies which were autopsied in the former years, there must have been ulcers which were overlooked, especially in the duodenum. An explanation of this is the fact, now admitted by many of the authorities—Ewald, Kemp, Pewsner,¹³ Mayo, and others—that the scars left by numerous healed duodenal ulcers are scarcely visible to the naked eye; that ulcers of a certain type in the duodenum heal readily and spontaneously between the attacks, and the scars are then only recognizable with the help of the microscope, by means of which a flaw is discoverable in the muscular coat. Yet it seems to be certain that many duodenal ulcers are of a more obstinate and progressive kind, and that these tend to become deeper and indurated with time, so that finally they are very difficult to heal and very liable to perforate; and when they do heal, stenoses result necessitating operative treatment.

A somewhat comprehensive study of the recent literature of peptic ulcer was begun by me while I was under the impression that the duodenal variety was considerably more serious and dangerous, as well as more prevalent, than the gastric, and that, therefore, it is highly important to make the differential diagnosis between the two varieties in order that, when the presence of duodenal ulcer has been made reasonably certain, there may be an earlier resort to surgery. But, in 1911, W. J. Mayo,⁶ in one of his scholarly papers, said, "A differential diagnosis between duodenal and gastric ulcer can usually be made without difficulty, but it is not essential." Moynihan² is still more emphatic in asserting that this diagnosis is easy, and insists in his book that it can be made from the history alone.

On the other hand, Sommerfeld¹⁴ and most of the Continental as well as many English and American writers express the opinion that the differential diagnosis between these two commoner varieties of ulcer is difficult and sometimes impossible. Sommerfeld¹⁴ says that "only when all the symptoms mentioned are present may we venture to make a probable diagnosis of duodenal ulcer," and that in

the other cases we can only suspect it. As agreeing with him in this view he cites Leube, Ewald, Boas, Lieblein, Hilgenreiner, Dieulafoy, Bier, Schottmueller, Kuttner, Kemp, Plehn, Koerte, Kehr, and Kuemmer. Of the internists everywhere, nearly all take the view that the diagnosis is not always possible, but we must concede that the opinion of surgeons who have opened many hundreds or thousands of abdomens in the living is entitled to great respect. The Danish surgeon, Kemp,¹¹ thinks that the fatality of duodenal ulcer has been exaggerated, and also that it should be treated by internal measures till these fail.

American and English statistics have proved that duodenal ulcer is certainly more prevalent than gastric ulcer, and more careful investigation leads to the conclusion that it is only in advanced stages of the unrecognized and neglected cases that duodenal ulcer is the more dangerous variety; that the differential diagnosis is, therefore, of comparatively little practical consequence, but that by far the most important point is to get family physicians and practitioners generally to recognize peptic ulcer promptly in any of the three organs where it occurs, and put its victims under proper diet and other treatment within the first few weeks, if possible,—certainly within the first year or two of its existence,—instead of labelling the trouble with the meaningless term “dyspepsia,” and continuing some useless and often harmful treatment for years, till the ulcer has become a stubborn, calloused, intermittently painful and bleeding sore which nothing but the knife can cure, and which, besides, has a decided tendency to perforate, or, in the case of gastric ulcer (though rarely in that of duodenal ulcer), to undergo cancerous degeneration.

The authorities now, with a few exceptions, agree that peptic ulcer wherever situated, as well as, *a fortiori*, the antecedent, often associated, and probably causative, hyperchlorhydria, is generally curable at first by rest and medical treatment with the help of the appropriate diet. Hence the paramount importance of an early diagnosis.

Omitting any discussion of peptic ulcer in the œsophagus, which is rare, the object of this paper is:

1. To show how to make an early differentiation of peptic ulcer in the stomach or duodenum from the various diseases with similar symptoms and signs.

2. As a matter of scientific interest, even if not of great practical importance, to describe the group of symptoms which, when most of them are present, indicates in the majority of cases duodenal rather than gastric ulcer,—that is, when it is possible to make the differential diagnosis between them.

3. To describe the medical treatment which most of the Continental and English surgeons as well as the more conservative American surgeons and the internists generally agree should be tried for a “reasonable” time, as Wm. J. Mayo¹⁵ advises in ulcer cases, before invoking the aid of the knife.

4. To point out plainly just when further medical treatment would be likely to prove futile and when, therefore, a skilled abdominal surgeon should be called.

Symptoms of Peptic Ulcer.—The most frequent symptoms are pain and a sensitive area in the epigastrium, hyperchlorhydria, the vomiting of food, gastric juice, blood or altered blood; melæna; occult blood in the vomitus or stools, and a sensitive area over the eleventh or twelfth dorsal vertebra. In typical cases some or all of these symptoms are present, and in a small percentage (Morots says in 20 per cent.) all may be absent. Less frequent symptoms seen in the later stages, especially of duodenal ulcer, are pylorospasm, hour-glass stomach, and stenosis of the pylorus or duodenum. As to the frequency of the symptoms the numerous writers in different countries differ widely. All agree that characteristic of peptic ulcer in all of its three usual localities is the appearance of pain, often severe, at some interval after meals, its relief generally after full doses of an alkali and, in the case of gastric ulcer, after vomiting or copious belching; in the case of duodenal ulcer, relief of the pain also upon taking more food. Most authorities hold also that in the active stage of all peptic ulcers there is usually hyperchlorhydria and often hypersecretion, the latter most frequently in the duodenal cases. In Friedenwald's 1000 cases⁷ there was pain in 94 per cent., epigastric sensitive areas in over 90 per cent., and sensitive areas both in front and behind in more than one-half, with only 26 patients in whom no sensitive point was found.

The later writers give much prominence to the help afforded by the X-ray after bismuth meals, when interpreted by experts. The bismuth lodges in the ulcers, forming shadows over them, and they

are thus rendered visible, in the stomach especially. Hour-glass stomach, which is most frequently a result of ulcer, is easily seen, and in both gastric and duodenal ulcer pylorospasm; also stenosis of the duodenum or pylorus in many cases. Several writers, Moynihan¹² and the X-ray experts especially, describe the striking picture made by the abnormally rapid passage of the bismuth meal through the stomach and duodenum in the earlier course of duodenal ulcer.

In the active stage of peptic ulcer the patient usually has a hearty appetite, often an exceptionally sharp canine hunger, accompanied and caused by the large excess of hydrochloric acid, which produces excessive appetite and thus leads to overeating, the latter having doubtless originally been the cause of the excessive secretion. The patients do not usually come under the care of stomach specialists till after the long persistence of these abnormal conditions has so far exhausted the peptic glands that analysis, when the diagnosis is finally made, may show an approximately normal or subnormal acidity.

Of Friedenwald's 1000 cases⁷ analyses of the stomach contents were made in 810 with the following results: normal acidity, 376; excessive, 246; deficient or no free hydrochloric acid, 188. In most of the other reports of large series the results of analyses are not given. In Sommerfield's¹⁴ review of 44 carefully-studied cases of peptic ulcer, these are divided into gastric, pyloric, and duodenal ulcers. Slight hypersecretion was present in the fasting stomach early in the morning in 20 per cent. of the gastric ulcers, in 40 per cent. of the pyloric, and in 23 per cent. of the duodenal ulcers; a high grade of both hyperchlorhydria and hypersecretion in 20 per cent. of the gastric, 20 per cent. of the pyloric, and 54 per cent. of the duodenal ulcers. The average percentage of free hydrochloric acid and total acidity was high in all.

DIAGNOSIS

From Cholelithiasis.—This is considered very difficult by many writers. Jaundice, which is frequently present in gall-stone attacks (according to Anders, in one-half of all the cases), is rare in ulcer except when the disease involves the duodenal papilla. The pains in the former are apt to be more violent, more sudden both in be-

ginning and ending, and to radiate toward the back or right shoulder more often than in ulcer, though pain in either condition may radiate in those directions. More distinguishing is the fact that the pain from ulcer virtually always bears a definite relation to the meals as described under "symptoms," while in gall-stone attacks food ordinarily neither provokes nor relieves the pain. In the latter, too, deep pressure under the lowest rib while the patient takes a full breath will often demonstrate that the diseased liver is sensitive and considerably swollen, especially in the gall-bladder region. If a stone has passed, careful search should detect it in one of the next stools. Vomiting of food or gastric juice is common in both affections. Blood, coffee-ground matter, or occult blood in the vomitus or stools, which are very common in ulcer, are much rarer in cholelithiasis. Hyperchlorhydria is usually present in the active stage at least of ulcer, and may or may not be in gall-stone attacks. A tense right rectus may be present in both, especially when there is a complicating enteroptosis and when the ulcer is in the duodenum or near the pylorus on either side. The X-ray findings are totally different in the two diseases. In the advanced stages of ulcer, especially in the duodenal, nutrition usually suffers more, and the patients are more frequently anæmic, weak, and emaciated. The most important difference, however, is in the time and manner of the appearance of the pain with relation to the meals, and this is so marked that it would often suffice by itself to settle the diagnosis.

From Appendicitis.—The right rectus muscle is usually very tense in appendicitis, but is sometimes rather tense in peptic ulcer situated near the pylorus when the stomach is prolapsed, especially during the pain from ulcer in the duodenum. Except for vomiting and pain and tenderness, the other symptoms of ulcer are generally absent, but in appendicitis the two latter are usually felt lower down near McBurney's point, where there is often a plainly palpable tumor, and the pain may be referred to the region around the navel. In acute and subacute attacks there is also fever, which is absent in ulcer. The picture given by the X-ray is entirely different.

From Cancer.—In cancer of the stomach or intestine the pain is usually rather constant without regard to meals, though it is slight or absent in the beginning, and when the growth is in a position where it is not exposed to much pressure or irritation it often gives

little trouble for a long time. But there are rarely any notable remissions, and no relief follows vomiting, belching, or the administration of alkalis. Even when hydrochloric acid is present, the percentage steadily decreases, and the anæmia, debility, emaciation, and cachexia are progressive; in gastric ulcer the nutrition is usually fairly good; while in duodenal ulcer, though there may be spells of emaciation, there are usually marked remissions with often long periods of decided improvement in flesh, health, and strength, and free hydrochloric acid in both kinds of ulcer is nearly always excessive during the active stage, in marked contrast to its entire absence during the last year or longer in cancer. The appetite is generally good, often excessive, in ulcer with the tongue clean and red, while the opposite condition is the rule in cancer. Besides, shreds of tumor, when obtainable from the wash water or tube, will microscopically reveal its character.

Wm. J. Stone¹⁶ emphasizes the fact that the leucocytes are moderately increased in gastric carcinoma, average from 10,000 to 15,000, a very important point in the diagnosis, the leucocytosis being of the polymorphonuclear variety.

Dr. Theodore G. Davis,¹⁷ of Los Angeles, has recently described a reaction in the urine of cancer patients, the reliability of which has been confirmed in numerous cases in which the test was positive before and for several weeks following the operation, but gradually disappeared after the removal of the growth.

From Disease of the Pancreas.—In the acute forms of pancreatitis the violent pain, vomiting, and rapid collapse might be mistaken for the perforation of an ulcer or the rupture of an abscess elsewhere, but in either case the only hope usually would be in a prompt laparotomy. In chronic pancreatitis there are often no marked symptoms, and, when palpable, the long transverse swelling in the epigastric region is distinctive. Diagnostic also would be the history of absence of acute pain at definite intervals after meals, and the results of examinations of the stools, which in pancreatic disease show an excess of fat, and also the undigested nuclei of meat after a Schmidt meal, while in most cases of ulcer there is only the normal amount of fat and completely-digested meat. High acidity in the stomach contents during the active stages of the disease would be in favor of ulcer. A positive Cammidge reaction would exclude gastric

ulcer, though, in the opinion of Brinton,¹⁹ not duodenal ulcer. In cancer of the pancreas the tumor would be unlike the slight thickening often discoverable in chronic ulcer, and the X-ray would show a marked difference.

From Hyperchlorhydria.—Pain appearing regularly two to five hours after meals and relieved by an alkali or more food is the most marked and frequent symptom of both hyperchlorhydria and duodenal ulcer, though exceptionally it may sometimes appear very soon after a meal in the latter and very late in the former. If the pain is not severe, nor accompanied by sensitive points in either the epigastrium or lower spine, by occasional bleeding, occult blood, or frequent vomiting, it is probably merely the result of an excessive secretion of hydrochloric acid, but it should be regarded as threatening ulcer and treated accordingly if it does not yield promptly to diet and alkalies. As for the severe and persistently painful cases, I am inclined to agree with Moynihan that "recurrent severe hyperchlorhydria is duodenal ulcer," but to differ very positively with him in the opinion that the knife is the only hopeful remedy.

Differential Diagnosis of Duodenal from Gastric Ulcer.—Decidedly characteristic of the former variety of ulcer is the usually much longer period of comfort after meals and the marked periodicity of the attacks, which often come during periods of apparent health of very irregular duration, from a few hours to sometimes weeks or months, during which periods the pains recur ordinarily at certain regular intervals after meals, varying from one to five hours, or as soon as the patient becomes hungry, often awakening him from sleep in the night. These are relieved by more food, drink, or alkalies, while in gastric ulcer the pain is relieved also by vomiting or copious belching. Bleeding is common in both varieties, but hematemesis is more frequent in gastric and melæna in duodenal ulcer. Of Friedenwald's 1000 cases,⁷ including 529 duodenal ulcers, there was melæna in 287 of the latter and occult blood in 315. In the 287 duodenal cases with melæna there was no hematemesis, but it occurred in 22.8 per cent. of the whole number of both varieties. In Sommerfield's 44 cases there was hematemesis in 33 per cent. of the duodenal, the same in the pyloric, and 60 per cent. in the other gastric ulcers; also melæna without hematemesis in 14 per cent. of the duodenal cases.

Painful pressure points in duodenal ulcer are generally a little

to the right of the middle line in the epigastrium as well as in the lower spine, and the pains more frequently radiate toward the right. The X-ray showings are markedly different, as already explained. Moynihan ² and Bier ¹⁸ insist that duodenal ulcer is aggravated more than gastric ulcer by cold, damp weather. The history carefully elicited is often more significant than the symptoms and signs, and there are unquestionably cases in which only an exploratory incision will decide the diagnosis. In all such doubtful cases, however, rest-dietetic treatment should be immediately instituted unless dangerous complications are present.

TREATMENT

Absolute functional rest of the stomach and upper bowel for a week or ten days, the patient being meanwhile nourished exclusively by rectal feeding, is an indispensable condition for ensuring a cure without surgery in any kind of peptic ulcer; and when the patients are fairly strong I have found a complete fast for some days at first to be still more effective. If resting in bed they bear such a short fast well. Only little sips of cool water or ice pellets should then be allowed, though the mouth may be rinsed as often as desired. The rest in bed should be continued for three or four weeks, and in the worst cases still longer.

When stomach feeding is resumed, the diet should be limited for the first week to milk given in quantities of from half a tumbler to a tumbler and a half, or even exceptionally two tumblerfuls, every two to three hours with one-sixth part lime-water or Vichy water. Then by the end of two weeks it is usually safe to add to the daily ration one to three raw eggs beaten thoroughly instead of the alkaline water. Later the blander preparations of beef, mutton, etc. (better in the form of finely chopped meat than broths) may be substituted for part of the eggs, and purees of vegetables be added. Still later mashed or baked white potatoes and the other more digestible vegetables—better chopped at first—may be allowed at three moderate meals daily. But all meats are very stimulating to the gastric glands, especially beef-tea and the broths, and the amount of such foods allowed should be strictly limited if a relapse is to be avoided. The broths and meat soups would best be given up altogether, and meat limited to one meal a day, and then only when exercise of some kind,

either active or passive, can be had regularly. Indeed, after the first week of the rest-cure, gentle massage of the body, strictly avoiding the abdomen, and Swedish movements should be provided so long as the patient remains in bed, and afterward till he or she is strong enough to take active exercise. And no ulcer patient should ever be dismissed without an emphatic warning from the physician or surgeon, whichever has cured him, that he cannot afford to risk the danger of a relapse by trying again to "eat everything," including pepper, mustard, and other stimulants, or return to his former probable habit of overeating, especially while leading a sedentary life.

Next in importance for the cure is the administration for from ten days to two weeks of bismuth subcarbonate in doses of from twenty to thirty or even forty grains, in bad cases, three or four times a day in an emulsion with water or milk. Large doses do not so often constipate as small ones, but, if they should, the bowels should be kept open in some way, preferably by enemas of soapsuds—not of salt. If pain should persist in spite of these measures, as it very rarely will, sufficient bicarbonate of soda should be given to neutralize the hyperacidity. If half to a full teaspoonful, or, at the most, a teaspoonful and a half, dissolved in a tumblerful of water should not relieve the pain, it may be inferred that cancerous degeneration of the ulcer has probably occurred, and opiates may then be necessary. Otherwise no opiates should be allowed, since they all stimulate the secretion of hydrochloric acid, and thus tend to aggravate any peptic ulcer.

Locally either dry heat or hot poultices or packs should be kept over the abdomen except when there is hemorrhage, and then ice-bags will do more good. In most cases of peptic ulcer the general health has been impaired to some degree, and roborant measures and remedies should form a part of the treatment. If the rest-dietetic cure can be carried out in a mild, dry, stimulating climate, so much the better. Sleeping out of doors on a covered balcony will also help when it is practicable, during the warm season at least. The value of limited massage has been mentioned. Small doses of medicinal tonics are also useful at times in the later management of these cases.

The foregoing scheme of treatment includes the main features of the Leube method except as to the broths, and in my own experience has been very successful when patients have been willing to submit to it. The anonymous writer on "Therapeutics" in the *Journal of*

the American Medical Association, though he holds that duodenal ulcer is properly a surgical disease, contributed to the number of June 22, 1912, the best article on the medical treatment of that disease which I have yet seen.

The two most extensive series of case reports of gastric and duodenal ulcer which have probably ever been published are those of Friedenwald⁷ and the Mayo⁶ brothers which have already been referred to in this paper. Friedenwald selected out of the records of 12,598 gastro-intestinal cases 1000 of peptic ulcer after rigidly excluding all concerning the diagnosis of which there could be the slightest doubt. Of this number 91 were treated surgically with 71 per cent. of cures, 22 per cent. were not cured but survived, and 70 per cent. died, 10 of the patients on account of perforations. Of the 64 cases cured by operation, 41, or 91 per cent., remained well five years or longer. Of the 1000, 885 were under observation during the entire treatment, and the remaining 115 were examined but not regularly treated for the prescribed period. There were also 273 ambulatory patients, 110 of whom took subnitrate of bismuth with 50 per cent. cured, 153 nitrate of silver with 47 per cent. cured, and 10 olive oil with 40 per cent. cured. The rest-dietetic treatment was followed in 521 cases, 404 according to the Leube method, and 117 the Lenhartz, with 72 per cent. of cures by the former and 66 per cent. by the latter. Of the 291 Leube cases cured, 62, or 74 per cent. of the 83 kept under observation, remained well five years or longer, and of the 78 Lenhartz cases cured, 35, or 77 per cent. of the 45 kept under observation, remained well for the same time. A few cases were fed by Einhorn's duodenal method with satisfactory results.

The results of the surgical treatment by the Mayo brothers⁶ in their 1000 cases at St. Mary's Hospital, Rochester, Minn., make a very much better showing than those of the Baltimore surgeons as reported by Friedenwald. Up to the year 1906 the technic of the Mayo operations had not been fully perfected, and the results then were not so good as later. Previous to June, 1906, they had operated on 227 gastric ulcers, including under that name all those around the pylorus, and 152 duodenal ulcers. From that date to the 17th of January, 1911, they operated on 201 gastric and 401 duodenal ulcers, also on 19 cases in which an ulcer was found in

both the stomach and duodenum. The operative mortality in the whole series, including both complicated and uncomplicated cases, was 2.4 per cent. Two years ago W. J. Mayo⁶ wrote that with the steadily-improving technic the mortality in the surgical treatment of ulcer had been brought well below 2 per cent. In the two years since then, with constant improvement in skill and technic, it has doubtless been brought still lower. In the hands of the most expert laparotomists and with the best possible after-treatment it may go below 1 per cent., especially when the operation is done in uncomplicated cases.

Still, in all these simple cases, especially when they have not been neglected for many years, the rest-dietetic treatment, with the help of bismuth and alkalies as required, should certainly first be given a trial. Practically all internists the world over, and all except a few of the more radical surgeons now concur in this conservative advice. But in any case of peptic ulcer only thoroughly trained, skilled, and experienced physicians should direct the treatment; and whenever there is uncontrollable vomiting or hemorrhage, or evidences of perforation, stenosis, or obstruction from any cause, there should be an immediate resort to surgery.

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TREATMENT OF DISEASES OF THE HEART

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RECALLING my last lecture on the "Diagnosis of Diseases of the Heart," * special consideration was accorded to the cardiac reflexes. Recognition and elicitation of the latter are of great value in cardiotherapy.

There are neither exclusive nor specific methods in therapeutics, and the synergistic action of different remedies must be conciliated. Pharmacotherapeutic methods are not unlike physiotherapeutic methods in their physiologic action.

Failure of the heart is essentially a muscular question, although a neuromuscular factor cannot be ignored. In cardiac insufficiency (decompensation) the cardiac muscle (myocardium) is at fault. Space will not permit me to discuss the forms of heart-failure. They may be of inflammatory genesis, and may include endocardial, pericardial, and myocardial inflammation. It may be of arteriosclerotic origin, or may be due to obesity, syphilis, acute or chronic thyrotoxicosis, and a variety of other causes.

I shall not recapitulate the symptoms of cardiac insufficiency beyond saying that you must differentiate failure of the left from that of the right side of the heart. In practically all instances percussion demonstrates an increased area of cardiac dullness to the right or the left or both sides.

The latter statement emphasizes the truisms: "With an apex beat in the normal situation and regular in rhythm, the auscultatory phenomena may be practically disregarded," and "The position of the apex of the heart is the key to the diagnosis of nearly all affections of the chest and heart."

In very rare instances there is a form of cardiac failure in which the area of cardiac dullness is diminished. To augment

* INTERNATIONAL CLINICS, vol. ii, 23d series.

tonicity of the myocardium and thus diminish indirectly the volume of the heart, it is usual to employ a reliable preparation of digitalis. But before using digitalis for diagnostic or therapeutic purposes, I first unload the bowels with a few small doses of calomel, followed by a purgative. Then I give an infusion of the drug in 4-fluidrachm doses, combined with 15 grains of diuretin, three times a day. Diuretin (sodiotheobromin salicylate) is a powerful diuretic, and antagonizes the vasoconstrictor components of digitalis.

The more recent researches of Löwy seem to show that digitalis dilates the coronary and renal vessels; this observation, however, is not wholly in accord with clinical results. No theory can guide you in the use of digitalis, and its tentative administration is always warranted, provided you begin with small doses and are prepared to recognize any untoward effects. The action of the drug is shown in the therapeutic stadium by an increase in cardiac force and only a slight slowing of the pulse.

In the toxic stadium the pulse is much diminished in frequency, and may even become arrhythmic. This excessive slowing of the pulse may be accepted as the primary signal of the toxic action of digitalis. Within 36 hours after the use of a reliable preparation of digitalis, given in adequate doses, the pulse should become stronger, more regular, and slightly decreased in frequency (provided it was previously accelerated), and diuresis augmented. By estimating the quantity of excreted urine, you possess a dual guide: the reliability of the drug and the efficiency of the myocardium. In cardiac insufficiency the quantity of urine may be diminished one-half or more. The increase of urine does not occur until the second day after the use of digitalis; then it increases day after day until the normal is attained (1500 Cc. in 24 hours in a healthy adult).

The chief effects of digitalis are exerted on the myocardium, and the greater the integrity of the latter the better is the action of the drug on the heart. This reaction may be accepted as a diagnostic indication of the condition of the heart muscle. The more intense the myocardial degeneration, the more susceptible is the reaction to small quantities of digitalis. If toxic in lieu of physiologic effects are observed after the administration of digitalis, one may conclude that the myocardial changes are pronounced, and that the use of the drug is positively dangerous.

I shall mention one other drug, strophanthin, which when given intravenously manifests its full action in one hour. But by the mouth this action is not perceptible for at least 17 hours.

When you recall that it takes 36 hours to secure the physiologic action of digitalis, you can understand the advantages accruing from the use of strophanthin if rapid results are desirable. Used intravenously, a single injection of strophanthin will, in most instances, fully restore a patient with cardiac incompetency.

A reliable preparation of strophanthin is that of Thomas, which may be given in doses of from $\frac{1}{4}$ to $\frac{1}{2}$ mg. (gr. $\frac{1}{240}$ to $\frac{1}{120}$). It is procurable in sterile vials.

When you desire permanent results from cardiotherapeutic, due consideration must be given to definite etiologic factors. Thus, in suspected myocardial disease due to syphilis, a positive Wassermann reaction may prove as valuable as a like reaction in the diagnosis of aortic insufficiency of luetic origin, and the therapeutic results with mercury and potassium iodide will clinch the diagnosis.

In the heart-failure of obesity a reduction cure is indicated. All must concede that the Schott methods of treating failing heart power by saline baths and resisted movements have created a new era in cardiotherapeutics. There are many theories concerning the action of these physiotherapeutic methods, but the view that best accords with reason is that which assumes their action to be due to the elicitation of the heart-reflex.

I have already demonstrated to you that percussion of the muscles will cause a heart-reflex limited to the right heart, and that cutaneous stimulation of any kind will result in a vigorous recession of the entire heart muscle. In my opinion, mere friction of the skin with a coarse towel is equally as efficient as the waters of Bad Nauheim, in Germany, which owe their action to various chloride salts and to the presence of carbonic acid.

Dr. Bloch, of Franzensbad, uses douches of carbonic acid to elicit my heart-reflex of contraction.

The symptoms of broken compensation from myocardial disease may be quickly differentiated from a host of other maladies by concussion of the seventh cervical spine to elicit the heart-reflex of contraction. Within several minutes after concussion dyspnoea, cyanosis, and other signs of an insufficient heart become less evident

or disappear for several hours, and for a longer interval with repetition of the concussion.

It is impossible for the uninitiated to conceive the rapid results attainable by this simple mechanical method of cardiac stimulation. I have seen several patients with pneumonia and practically moribund in whom the conventional cardiac stimulants were employed without avail; yet these very patients were not only revived but revived quickly by my method of vertebral reflexotherapy.

When it is a question of fortifying the jaded cardiac musculature, I rely chiefly on concussion of the seventh cervical spine; and, if this fails, one may conclude, as a rule, that the cardiac musculature is no longer capable of restitution.

In a report to the "French Academy of Medicine," August 21, 1912, Marie and Jaworski reported their results with my methods of vertebral reflexotherapy in advanced tabes. They observed that treatment for ten minutes by the latter method was equivalent to six months' treatment by Fraenkel's methods, and that after several *séances* the benefit was permanent.

The results attained by Marie and Jaworski correspond to my own in the treatment of cardiac insufficiency, and a conservative estimate of my method permits the conclusion that more can be accomplished with it in one week than by three months' treatment with the conventional methods of Schott.

The best results are secured with an apparatus giving a rapid percussion stroke. In the absence of an apparatus, use mere concussion with a pleximeter and hammer. Strike for a period of time not exceeding 30 seconds, then rest for an equal length of time, and do not prolong the treatment beyond 5 minutes. Many *séances* are necessary before permanent results are achieved.

Remember that in executing this treatment you are eliciting a reflex, and that the latter may be exhausted as well as excited. In my early practice with this method my failures must be attributed to excessive treatment. In concussion to elicit the heart-reflex of contraction a real danger is its overuse, which conduces to exhaustion of the myocardium.

Until there is a moderate restoration of the myocardium, evidenced by a reduction in the percussional area of cardiac dulness, concussion should be employed only once a day. One frequently

observes cardiopaths with severe dyspnoea and other signs of heart-failure who obtain relief after a single *séance* of concussion treatment.

In failing compensation, however, concussion must not be employed to the exclusion of other methods of treatment; when the area of the heart is reduced, concussion should be performed only twice or thrice weekly. A curious physiological phenomenon has been noted with reference to the exhaustion of neurogenic tonus by concussion at the seventh cervical spine. When this region is concussed you stimulate the vagus, as is evidenced by the heart-reflex of contraction. If overstimulation at this region no longer elicits the heart-reflex, the latter may be evoked from other areas, which leads us to conclude that the afferent paths only (not the vagus itself) become exhausted.

This phenomenon suggests the rationale of many therapeutic procedures and demonstrates how one may make use of other afferent paths in the excitation of centres which cannot be reached by paths already enervated.

In very rare instances you will find patients who cannot tolerate concussion, just as you will find an idiosyncrasy to electricity. Remember that in the employment of concussion you are only using one of many stimuli for discharging a reflex. This reflex may also be evoked by the rapid sinusoidal current applied in the same region. With an interrupting electrode at the seventh cervical spine and a large indifferent electrode in the sacral region, you can accentuate the heart-reflex. To prolong the heart-reflex, which is of limited duration, you may use the different forms of energy suggested in my recent work.*

Concussion of the seventh cervical spine for stimulating the vigor of the heart corresponds to *kuatsu*, or the Japanese method of restoring life. Kuatsu, or restoration to life, is an integral part of jiu-jitsu, which, as usually conceived, is not merely a means of physical training and a method of combat, for, when the victim is "knocked out," definite methods of resuscitation, known as kuatsu, are applied.

Many centuries ago, when jiu-jitsu was first used in Japan,

* "Physiological Physics of the Various Forms of Force in Progressive Spondylotherapy," 1913.

FIG. 1.



Method of applying kusten in the reviving of unconscious persons. Each time the heel of the hand strikes the seventh cervical spine, with rhythmic regularity, the arm is brought back to the position as shown in the illustration. When succeeding blows are struck, the elbow is brought into proximity with the body of the subject.

kuatsu was also employed for reviving unconscious persons, and later it was found to be equally effective in sunstroke, drowning, and injuries from various causes.

In *kuatsu* the subject is placed in the prone posture with arms extended sideways, and the operator with his wrist strikes severe blows upon the seventh cervical vertebra with the regularity of a carpenter striking with a hammer (Fig. 1).

As soon as the patient recovers consciousness, he is placed in a sitting posture, his arms are rotated, and he is aided in walking. The latter procedure is regarded as mandatory in the application of *kuatsu*, the object being completely to restore the functions of the circulation and respiration; otherwise, it is said, the patient will relapse into unconsciousness. Every policeman in Japan is taught this first aid to the injured.

If you have witnessed a prize-fight, you will have observed that between the rounds the region of the seventh cervical spine of the prize-fighter is vigorously rubbed with a towel or ice. The latter intuitional act will evoke a heart-reflex of contraction.

Vertebral reflexotherapy is also practised in a crude way by the Chinese as *Tcha-Tchin*. Commenting on this fact, the Abbé Grosier, at the end of the eighteenth century, observed, "*L'efficacité de ce traitement est prouvée par des guérisons sans nombre et qui semblent surnaturelles.*"

It is impossible for me to enumerate all the affections of the heart in which elicitation of the heart-reflexes is possible. Permit me to direct your attention to the affection known as angina pectoris. With increasing experience in the treatment of this affection, I am constrained to differentiate this disease into an angina without, and an angina with, an increase in the diameters of the heart. It is presumed that anginoid pains are caused by a transient ischæmia of the heart muscle, and experiments have shown that the vascularity of the organ through the coronary arteries may be compromised when the volume of the heart is abnormally contracted or dilated. The form of angina which I have described as the cardi tonic variety (no increase in cardiac diameters) corresponds to what is known as true angina pectoris.

It has long been known that patients who suffer from precordial pain obtain permanent relief on the supervision of cardiac dila-

tation and failure; and Broadbent has shown that an ensuing mitral insufficiency may diminish the tendency to anginoid attacks.

In the cardiotonic variety of angina a modicum of relief may be achieved by eliciting the heart-reflex of dilatation, and in that form which I have described as cardiectatic angina pectoris, which is associated with an increase in the diameter of the heart, symptomatic cure may often be effected by elicitation of the heart-reflex of contraction.

Let me cite the following history, which is my stenographer's verbatim report from the physician:

"My age is 52, and my weight 172 pounds. Several prominent physicians (names withheld) diagnosticated my case as one of true angina pectoris, and I was doomed to a life of hopeless invalidism. My father suffered from similar attacks of anginal pains which began at my age. He was, like myself, inclined to obesity. I am forced to give up my outside practice because the least exertion in walking, and particularly when cold air strikes my chest, brings on severe and radiating pains with a feeling of fear and oppression."

In this patient the cardiectatic variety of angina was demonstrated. Within three weeks after the beginning of treatment the patient was able to resume his practice, and after a period of several years he has been without any recurrence of symptoms. The treatment consisted in eliciting the heart-reflex of contraction; later efforts were made to produce a gradual reduction in weight, for it is impossible to conceive of any permanent benefit when the cardiac musculature is immersed in an atmosphere of fat. The fact that the patient's father had similar attacks at his age only emphasized heredity in relation to the tendency to corpulency which impaired the integrity of the heart.

The fact that many patients suffer from precordial pains when "cold air strikes the chest" led me to investigate this subject. I found that if one directs a current of cold air over the precordial region the heart dilates. In the norm this dilatation is slight, but it is accentuated in cardiac insufficiency. Inhalation of cold air produces a like, though less pronounced, effect.

This heart-reflex of dilatation, like its counter reflex of con-

traction, is mediated by the *vagus*, for when the latter is inhibited (pressure between the third and fourth dorsal spines) no reflex can be elicited.

Further observations have shown me that there are specific cutaneous nerves which influence visceral tone; nerves which, in response to a special irritant, will either contract or dilate an organ. Some patients suffer from anginoid pain after the ingestion of food.

My observations on this subject are not completed, but they have shown that, in patients with an insufficient myocardium, the ingestion of cold water will dilate the heart, but that no such effects are observed when warm fluids are ingested.

THE TREATMENT OF PULMONARY TUBERCULOSIS BY HYDROTHERAPY*

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GENTLEMEN: It has been repeatedly my painful duty during this course to inveigh against the criminal indifference of medical men to the uses of water in the treatment of disease and to point out by precept and by example that the result of this neglect is too often loss of life, as in sunstroke and typhoid fever, or the failure of the physician to keep a neurasthenic or other patient on account of his lack of knowledge of this most valuable remedial agent in these maladies. I must reiterate that the average text-book on therapeutics and practice is either silent on this subject, or mentions the application of water without directing the seeker after knowledge of the means of how it is to be applied. The technic, duration, temperature, etc., are rarely considered. As an example I may cite from one of the best text-books used in this school, a work that is so superior to others that it has been translated into several languages and has deservedly passed through many editions. In the chapter on treatment of tuberculosis the learned author advises water only under the caption of "fever treatment," stating that "cold packs, ablutions, and luke-warm baths are very agreeable." There is no hint regarding the temperature of the water and duration of the treatment. Naturally the reader would avoid a remedy which is intended only to be agreeable and with the scientific application of which he is not familiar enough to venture its apparently troublesome use.

In no disease is the external use of water at varying temperatures more potent for amelioration of symptoms and raising of resisting capacity, by the lack of which a fatal prognosis is too often inevitable. An explanation may be found in the fact that the

* Lecture delivered at the College of Physicians and Surgeons on May 8, 1913.

judicious application of neurovascular training, which you have seen and practised in the Vanderbilt Clinic, fulfils every therapeutic indication in this baffling disease. What is the object of treatment? This is a question you must ask yourselves in all diseases. The answer in this instance is:

1. To improve the appetite, digestion, assimilation, and, as a result, nutrition and hæmatosis.

2. Without violent exertion to deepen inspiration, thereby increasing oxygen intake and CO₂ elimination.

3. To enhance muscular activity judiciously for the purposes mentioned, avoiding it when a rise of temperature forbids.

4. To counteract the depreciating effects of toxæmia, as in other infectious diseases.

5. To remove stases in the vital organs and glands.

Let us consider how all these indications are met by skilful prescription of water, in its varying forms.

You have seen in the clinic how many chronic diseases of various types presenting depreciated conditions have been improved in appearance, nutrition, and weight. Unfortunately, tuberculosis cases are rarely referred to us by reason of fear on the part of our colleagues that their phthisical patients may be damaged. There is the same prejudice in many otherwise well-informed men against probable colds from cold water as formerly existed with regard to fresh air and cold water drinking in the exanthemata. You happen to have seen a striking illustration of tuberculosis of the metacarpal end of the radius which had been sent to us as a case of rheumatism: this accounts for his, to us, fortunate transfer to the hydrotherapeutic clinic. He has been our star exhibit, before several sections, of the value of neurovascular training. He was permitted to pursue his avocation as boss carpenter when his temperature descended below 100.4° F., which he presented, on admission.

The following outline may serve you as a guide in the average case. In the most depreciated conditions you may begin by having the patient stripped to the waist just after emerging from bed. With a harsh towel he may be rubbed vigorously or rub himself until the entire chest has been mechanically irritated. This may be repeated once or twice each day until the friction reddens the skin well. The next step on the following day is friction with a cloth

wrung out of water at 85° F., after which he is dried and sent into the open air. Every day this procedure is reduced two degrees until 60° F. is reached. Each day the cloth is allowed to retain more water. The affusion which you have practised in the clinic is the next procedure. Begin while the patient stands undressed in water at 105° F., by pouring a basinful of water at 80° F. over each shoulder, the back and front, drying and sending him into the fresh air. Reduce the water temperature each day, if reaction is good, until 60° F. is reached. The drip sheet is the next procedure. You have all practised this in the clinic and you may find it described and illustrated in my text-book ("The Principles and Practice of Hydrotherapy"). In institutions the douche is the next procedure. I have here a drawing of an inexpensive douche apparatus which enables one to regulate the temperature, duration, and pressure with precision (Fig. 1). In all procedures the chief guide must be the reaction manifested by each patient from each one of the methods applied.

I have coined the word "Neurovascular Training" in order to emphasize the fact that there are few, if any, cases that may not be profitably subjected to a graduated, daily increase of cold water, reducing the temperature, and increasing the duration slowly, and, in institutions, adding the pressure from the douche. By this method the reactive power of the nerves and vessels of the skin and its muscular structures which control the capillaries may be trained to respond with increased vigor, just as the muscles of the arm may, by slow and graduated accretion of weight, be trained to lift heavier weights.

In small sanatoria and in private practice the douche may be dispensed with; the drip-sheet affusions taking its place.

The first record in this country of carefully-observed cases of pulmonary tuberculosis under graduated water treatment was gathered under my direction as chief of the medical staff of the Montefiore Home for Chronic Invalids and Hospital for Consumptives. Some of the results attained in these cases were published in the *Transactions of the New York State Medical Society* for 1892. They may serve as examples of judicious hydrotherapy in this dread disease, so far as improvement of nutrition is concerned, for they were poor people from the toilers of the tenement districts in the most desperate straits, the conditions for admission requiring ab-

solite poverty and incurability. The record sustained every statement by bedside facts, citing cases in all stages of the disease in which the improvement in nutrition, with gain in weight and general vigor, was phenomenal, resulting in return to their vocation in some instances and even in remaining capable of work while under observation for several years. These patients were under constant observation of members of the staff of eighteen physicians; their sputum was examined by Dr. Hodenpyl, pathologist to several hospitals—there was no possibility of error. In none of them—and I want particularly to emphasize this fact—did the open-air treatment, now regarded as the most potent of all anti-tuberculosis remedies, play a rôle. For, despite the fact that in the planning of the building I had insisted upon a costly and perfectly-equipped Liegehalle, heated in winter and opening to the south, it proved impossible to induce these desperate people to submit to discipline by reason of the mistaken kindness of the directors, whose chief aim was claimed to be to soothe their dying days. Nor did I interfere with the, to my mind, inert medication (creosote, etc.).

In view of these facts we are warranted in claiming that the favorable results were attributable chiefly to the methodical application of water and to the good, wholesome food, for which they displayed no desire before their subjection to tonic hydrotherapy. Many of these people had, previous to admission, been treated *secundem artem* in our best hospitals and by competent private physicians, often with consultants. Water was the sole exception in their management, because it was at that time regarded as obnoxious in pulmonary ailments. The almost invariable outcome in these cases was improvement of the circulation, increase of appetite and consequent enhancement of nutrition and hæmatosis, together with increased excretions, and all these favorable results were attained without fatigue and its accumulated products of retrograde tissue change. In short, the most precious action of cold water in this connection is to elevate the resisting capacity of the organism to the inroads of this as of other depreciating maladies.

If you will always bear in mind the physiological action of heat and cold as conveyed through water to the skin, upon which I have dwelt with perhaps tedious emphasis, there will be no need of your following set prescriptions. All that you will be called upon to do

will be to reflect upon the therapeutic indications in each case as doubtless inculcated by my colleagues of the faculty. Then you will understand, from your knowledge of the principles of hydrotherapy, how to prescribe a tonic, calmative, stimulating, or sedative procedure. Apply to this matter the answer given by the great painter Millet when he was asked how he managed to mix his paints to obtain the brilliant colors for which he was famous. He said, "I mix them with brains."

IMPROVEMENT OF RESPIRATORY PROCESSES

This is best accomplished by living constantly in the open air. The favorable effect may be greatly aided by judicious hydrotherapy. When the human skin comes in contact with water below its normal temperature (92° F.) there is, as your earlier studies in physiology have taught you, an excitation of the thermic and sensory cutaneous nerve terminals, which is conveyed with lightning rapidity to the central nervous system, arousing, among others, the respiratory centre, as evidenced by a gasp and staccato breathing when the cold is intense. When the first excitation has passed the inspiration remains deepened and an increase of oxygen intake and CO₂ output are noted. The salutary effect of this deepened inspiration soon becomes evident in rapid rise of facial coloring, brightening of the eye, and disappearance of duskiness, all of which inure to improvement of the general condition. You will, of course, bear in mind in this as in every manifestation following cold procedures my hydrotherapeutic law: "The reaction is in proportion to the difference between the skin and the water temperatures, increasing and diminishing always with this temperature difference." You probably remember, too, that this rule is subject to modification by reason of the mental and physical condition of the patient, the type and stage of disease, and frequency of repetition that inures the skin.

OUTDOOR EXERCISE

It would seem a stretch of the imagination to expect the physiological reaction of exercise to be produced by the application of simple water. I show you here some diagrams drawn by two brilliant investigators, Vinaj and Maggiora, of Turin, which graphically

FIG. 1.



A simple form of apparatus for the application of the needle-bath.

demonstrate the truth of this astounding proposition. These observers have given us some valuable laboratory data on the enhancement of muscular vigor by cold water and its *diminution under warm water if given without the mechanical stimulus of atmospheric pressure*. By repeated experiments with the ergograph of Mosso, to whom they submitted their results, they ascertained the fatigue curve (line) before and after water procedures of various kinds. The middle finger of the right hand, for instance, was made to contract with the greatest exertion, lifting a weight of one kilogramme until fatigued; the point of exhaustion was reached after 50 contractions, two seconds apart. This was calculated to correspond to a total of 5.139 kilogrammes' work, while after a plunge-bath of fifteen seconds at a temperature of 50° F. the same finger was capable of completing 74 contractions before fatigue ensued, corresponding to 9.126 kilogrammes' work.

In an interesting article on the rationale of rest, published in the May number of the *Journal of the Outdoor Life*, by Professor Lee, Columbia University,¹ the effect of rest is shown in a diagram which I show you in order to impress you by comparison that a similar effect is produced by cold-water procedures. In one of the figures the fatigue lines, after muscular action, are shown; another illustration shows how the lost muscular vigor was restored by the cold drip sheet, which is always, as you know, given with active friction.

Professor Lee writes: "There is no known antidote for fatigue (with all its detrimental products), unless it be rest." That we possess another and perhaps more powerful "antidote" in cold water administered with friction can be demonstrated.

That the beneficent effect of hydrotherapy upon fatigued muscle is at least as powerful as the good effect of rest is obvious. The result is an improvement in the cardiac action and consequent better distribution of blood, preventing stasis by driving blood and lymph through unwonted channels. The products of fatigue and tissue change are actively eliminated, and a general refreshment enhances the resisting capacity of the organism. The salient fact, however,

¹"The Physiology of Rest and Exercise," Frederick S. Lee, Ph.D., *Journal of the Outdoor Life*, May, 1912.

is the enormous advantage of muscular activity produced by water over that resulting from exercise, in that the former causes no irritation of the respiratory process nor rise of temperature, both of which are so decided a menace to the consumptive that exercise is interdicted when the temperature has risen above 100° F. The loss of the valuable act of walking is always detrimental and may not rarely change the prognosis, while cold-water procedures do not disturb the patient's respiration and lowering the temperature add to the patient's chances of recovery. Recently a high authority, Dr. Marcus Patterson, of the celebrated Brompton Hospital for Consumptives, has published marvellous results from gradually-increased exercises which are analogous to my method of neurovascular training. Light exercise is prescribed, and this is increased by small increments from day to day or less frequently until the patient finds himself accomplishing the most astonishing feats without detriment. This is the secret of success in the method of neurovascular training which I devised in the Montefiore Home for Consumptives two decades ago ("Principles and Practice of Hydrotherapy," Wm. Wood & Co., third edition, p. 413). I would urge you to try this method in every depreciated case if you would obtain the refreshing action of exercise without its detrimental action.

TOXÆMIA

This condition manifests itself by vasomotor depreciation, which is common in all infectious diseases. We observe cardiac enfeeblement with its resultant loss of tension of the pulse, shallow respiration evident in more or less cyanosis, rise of temperature, and inhibition of renal excretion. We have also night-sweats and sometimes delirium. These menacing conditions may be successfully forestalled or met by ablutions, the towel or the half pack of 60° F. made of three folds of linen wrung out of water at 60° F. and wrapped around the upper half of the body from axilla to pelvis, then secured by a thin one-layer bandage of thin flannel binder. This pack may be renewed every hour or two when the skin has warmed up, as you have learned in the clinic. The result is shown by refreshment of the nervous system, and consequent restoration of circulatory and excretory activities. The cough in

this disease is remarkably influenced by the chest compress prepared as you did in the clinic (see p. 142 *loc. cit.*) for pneumonia. Renew with care always.

High temperature is met by abdominal compresses, ablutions, and tub-baths of 90° F. prolonged for ten or fifteen minutes, with gentle friction and occasional affusions at 80° to 75° F. The latter must follow every tepid bath before the patient rises from it. Another valuable and less disturbing procedure is the towel bath as described on page 105 (*loc. cit.*), also the sheet bath, pages 115 to 117.

Bear clearly in mind that in all infectious diseases there is an increased retrograde tissue change, and owing to the sluggish circulation in the glands there is defective oxidation and consequent retention of the products of tissue change. The enormous increase of well-oxygenated blood, resulting from cold procedures, enhances glandular action and serves to diminish, and often entirely to remove, this serious condition, which slowly conduces to a fatal issue.

REMOVAL OF STASIS

In all infectious diseases the brunt of the disease falls upon the circulation, to the failure of which the final issue is often due. Stasis in the vital organs cripples the secretory, excretory, and assimilative functions by which life is sustained. We have no medicinal agent which even temporarily removes capillary stasis, except digitalis in valvular insufficiency. By the judicious adaptation of the cold procedures which I have referred to, stases are removed, by reason of their tonic effect upon the cutaneous and consequently also upon all peripheral vessels.

The effect of neurovascular training upon the circulation is marked, by reason of the vasomotor stimulation which primarily affects the capillaries. In addition, there is an action upon the "skin-heart" which has not been sufficiently appreciated. You are aware that I hold that, since the capillaries have no muscular nor elastic coats, their narrowing under cold water is due to the cutaneous muscular fibres, which are contracted by the cold. These compress the capillary network with which they are interwoven, and thus aid the vasomotor action by increasing the resistance at the periphery. The result is an immediate response of the heart, with increased

ventricular contraction and all the potent influences flowing from an enhanced cardiac tone, removal of stases, exudates, and enhanced nutrition and elimination. Moreover, the well-known favorable action of cold procedures in other infectious diseases evoked by their effect on the peripheral circulation may be expected in tuberculosis also. This is a clinical fact observed in all febrile cases especially.

Let me warn you again to be precise and painstaking in all your hydiatric prescriptions, and to be specially alert to obtain good reaction. The latter need not be manifested by cutaneous reddening to be satisfactory; but a sense of fatigue or decided chilliness should never follow any procedure. If it does ensue, make the procedure more brief and add friction during and after the treatment; do not abandon it, but change the technic.

During the last quarter of a century I have not prescribed medicinal tonics for any patient, because a systematic neurovascular training, which may be administered in any household, has been effective in the improvement of appetite and in the increase of blood-cells and muscular and circulatory capacity, as evidenced often in gain of weight and general vigor. This statement is based on hundreds of blood-counts and weight records. The rationale is simple, as I have explained in the lectures on the theory of hydrotherapy. Unfortunately, it is invariably disregarded in the textbooks, which very properly detail the action of all medicinal agents. The so-called shock from cold water is, as I have told you, dreaded without reason; it is not, like surgical shock, "a depression of the vital powers," but rather a surprise to the cutaneous nerve terminals, furnishing thermic and mechanical excitation, which, as you learned early in your student days, is conveyed to the central nervous system, and is thence reflected upon all the structures in connection with the latter.

I have frequently impressed upon you that water, like all remedial agents, is capable of ready application and dosage, and that its action is explicable on a rational basis. But the most important test of a remedy is its clinical value.

CLINICAL DEMONSTRATION

On the subject of typhoid fever, pneumonia, sunstroke, neurasthenia, and other diseases I have presented to you irrefutable bedside

evidence. My personal observations recorded in the annual reports of the Montefiore Home in the early nineties furnish reliable clinical data on pulmonary tuberculosis. Lest, however, I should be charged with undue enthusiasm, I shall furnish you with confirmation from other sources.

Dr. Kuthy, of the St. Elizabeth Hospital, Budapest, has reported 1000 cases of tuberculosis in which hydrotherapy was a prominent remedial agent. Kuthy is so convinced of its value that in his opinion "sanatoria for tuberculosis will never do justice to their difficult demands without hydrotherapy by properly-instructed attendants." He reports 53.9 per cent. of his tuberculosis patients clinically cured in 1893, after two years' observation and tracing. Kuthy pursues the same method as I do, viz., a gradual accustoming of the patients to cold-water applications.

That there is a difference, however, in the results from hydrotherapy under different methods is evident from Kuthy's comparison of his own statistics with those of the great sanatorium at Belzig, near Berlin, in which the patients were subjected to douches chiefly. The latter were in vogue when I visited the great sanatoria Goerbersdorf, Guppertsheim, and Falkenstein, where I was astonished to find that a shower one foot in diameter, discharging a mass of water at 47° F., was applied to patients who were improving. Only a small proportion of selected cases could bear such heroic treatment. The statistics of Belzig were 39 per cent. cured in 1905. As compared with 59 per cent of Kuthy, the milder hydrotherapy is far preferable, especially since it may be well executed at the patient's home or in smaller institutions.

Note.—Kuthy's methods are worthy of imitation:

1. "Fever patients (over 99° F., mouth) receive every morning a partial wet rubbing, as follows: The patient protrudes one arm from beneath the bed cover. A small towel partly wrung out of water at 90° F., daily reduced one degree or more until 70° is reached, is wrapped around the upper two-thirds of the arm (bedding being protected), and with this wet towel the arm is well rubbed, then rubbed dry until it is red. The other arm, the thighs, the back, and chest are successively treated, the towel being freshly dipped and wrung out each time.

"This procedure is of inestimable value in the phthisical—it

invigorates, hardens, improves the appetite, moderately abstracts heat, improves the peripheral circulation, and is *the best means of combating night-sweats*. In obstinate cases of the latter the procedure may be repeated at bedtime.

2. "After the patient has rested from these, and is thoroughly reacted (say in two hours), he receives a trunk compress, reaching from axilla to symphysis pubis.

"We have scarcely one patient who has not reported subjective improvement. Even in desperate cases we have often seen cessation of loss of flesh, improvement of general tone, etc. Hæmoptysis, though not improved by this treatment, is never aggravated, while the general calming effect is of advantage, while the eternal and bothersome medication in these desperate cases is certainly of little benefit.

"In hectic fevers, due to mixed infection, we have had no effect on the fever, only a calming effect and some increase of appetite.

"In patients not confined to bed (afebrile) a most frequent procedure is the half-bath. The patient sits in a tub, water reaching to the navel, the head being wrapped in a wet turban. Water is dipped up rapidly and poured upon the back and chest of the patient several times, then the parts are rubbed with the flat hand of an attendant for two minutes, and then water is again poured over the front and back. Temperature of water 90°, reduced every three days one degree until 82° is reached. This bath is well borne by the weakest (afebrile) patient, if care is taken to rub him well during and after the bath, especially the extremities. The tonic effect is striking."

The renaissance of tuberculosis management was initiated by Brehmer, of Goerbersdorf, who, in the face of criticism, ridicule, and obloquy, persisted in the claim that tuberculosis is curable by the physiological agencies—air, water, exercise, rest, and diet. These remedial agents are fully treated in every American work, and they have been the frequent theme of discussion in societies, *with the exception of water*. I hope you may aid in rescuing water from this unmerited neglect, and in showing that the latter originates in unfamiliarity with the principles and practice of hydrotherapy.

PRACTICAL POINTS IN THE MANAGEMENT OF SOME PULMONARY DISEASES

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BRONCHIECTASIS

Diagnosis.—This is oftentimes difficult, especially in fusiform lesions, unless the case is advanced; we suspect bronchiectasis from the conditions leading to it. We must differentiate from: (1) Chronic bronchitis, by signs of a cavity, with irregular and profuse expectoration, influenced by position. (2) From a tuberculous cavity, by the absence of the tubercle bacillus, the comparative absence of emaciation, night-sweats, and fever, and of the regular tuberculous symptoms and cachexia; the sputum is rarely nummular in bronchiectasis. Frequent and slight hemorrhages for years in a well-nourished patient would suggest a sacculated bronchus. A cavity in the middle and lower third of the lung, especially low down and posteriorly, suggests bronchiectasis, though this lesion may be found in the upper lobes. In phthisis signs of consolidation precede cavity formation, whilst they follow cavitation in bronchiectasis. (3) From a sacculated empyema perforating a bronchus, by the history of pleurisy, and by the infrequent expectoration of the latter. (4) From actinomycosis (which is rare), by absence of the ray fungus in the sputum. (5) From cancer, by the primary carcinoma, the glandular enlargement, and the cancerous cachexia. (6) Feter may suggest gangrene; here (as also in abscess) the general symptoms must aid in the differentiation. The course in abscess is much more acute than in gangrene.

Prophylaxis.—Much can be done to prevent bronchiectasis. In chronic bronchitis stimulant expectorants should be persisted in, and the position changed often (even the pelvis being raised to promote expulsion of the sputum). Patients who have had delayed

resolution in pneumonia should use breathing exercises (after all acute symptoms have subsided), and should lie on the sound side, to prevent consolidation and such interstitial changes as would tend to traction on the bronchi. Pleural effusions should be early evacuated.

Treatment.—This is unsatisfactory. Cure is not expected; but the patient may attain even advanced age under good medication and management of accompanying affections. Hygienic measures are essential; a suitable climate must be selected. Balsams are indicated and creosote, benzoic acid, balsam of Peru, quinine, salol, and terebene (℥v, every 4 hrs.) should be prescribed. Stimulant expectorants are taken, as in chronic bronchitis. Hemorrhages are treated as in tuberculosis. Inhalations should be given of carbolic acid or thymol, or the following: ℞ Eucalyptol, gr. xx; creosote, 3i; alcohol, ether, chloroform, āā 3v. Osler advises creosote vapor: The eyes are protected; the nostrils stuffed with cotton; 3i of creosote placed in a saucer of water is vaporized over a spirit lamp and inhaled. This is done every other day for fifteen minutes, and progressively increased to an hour daily for three months. I have had excellent results by intratracheal injections of menthol, 10 parts; guaiacol, 2 parts; and olive oil, 88 parts; a drachm of this to be injected twice daily when possible.

In sacculations in the lower parts of the thorax, evacuation is most difficult; this is promoted by reclining in a modified Trendelenburg position. The patient is advised to take this position for an hour in the morning and, if possible, again at night; changing from side to side until he ascertains which position favors the most copious expectoration. Compression of the regions involved, "coughing downward," may also promote this. It is accomplished by the patient, several times a day, lying on the bed, with one hand on the floor and the head almost reaching the floor. By thus not waiting for the cavity to fill, the patient experiences great relief, and often improvement.

Surgery may be necessary as a last resource,—incision and cavity-drainage. Resection of ribs and mobilization of the chest-wall may compress the lung tissue, and thus close up gaping cavities. Wonders are now accomplished in such surgery under intratracheal anaesthesia, and by recourse to the double pressure chamber of Willy Meyer.

BRONCHIAL ASTHMA

The essential characteristic of this disease is a severe and most distressing paroxysmal recurrent dyspnoea, due to bronchial contraction. It occurs from childhood to old age, but begins usually in the young, and especially in males. In general, the nervous system is at fault.

Causes.—These are unusually various, and successful treatment requires their most careful study in each case. We may, for convenience, consider first those which seem to act directly on the respiratory mucous membrane, and then those which act indirectly through the blood and nervous system. Some patients have asthma only when exposed to a direct cause, whilst others have constantly recurring attacks without, apparently, any direct cause. In these latter cases there is some secondary cause, perhaps as yet undiscovered, the treatment of which will yield most gratifying results, and will redound most fortunately to the physician's credit and reputation.

First among the *direct* causes we may find, on examination of the upper air passages, polypi, exostoses, deflections, hypertrophic rhinitis, adenoids, hypertrophied tonsils, or other unhealthy conditions from the nostrils to the trachea.

Next comes dust of all kinds—common street dust, which on examination will be found to contain molds, fungi, bacteria, and many other most offensive and irritating particles, both organic and inorganic; fluff from woollen clothing; the dust of mills, of foundries, threshing-floors, bake-houses, and dust evolved in many offensive trades—such particles may when inspired produce asthmatic seizures.

Many odors will produce asthmatic attacks—odors of pitch, of phosphorus, of sulphur, and of other chemical vapors; the emanations of such animals as dogs, cats, horses, hares; the odors of vegetables such as ipecac, and of plants and flowers as, perhaps, the rose; the pollen of plants and grasses.¹

Climatic influence is an enormous factor in the development of

¹ Here hay fever or hay asthma is akin to bronchial asthma, having the like cause and sudden onset; they differ only in the site of the affection, and in the seasonal occurrence of the latter.

asthma; here we have to deal very largely with idiosyncrasy. Extremes of temperature, or excessive dryness, or excessive dampness, may in individuals produce the seizure. Thunder-storms may bring on attacks. Here, however, we distinguish two classes of cases: those who suffer from dampness in combination with either heat or cold; and those who are especially affected by close atmospheres in which there is not sufficient change of air, as in deep valleys and thick forests. A breeze springing up greatly relieves the latter patients.

Next and most important among direct causes are pulmonary lesions. Various forms of bronchial irritation (especially of the bronchioles), either idopathic or coëxistent with such other diseases as measles or pertussis, are provocative of asthmatic seizures. Pulmonary indurations, especially at the root, are causative; as are also those lesions of the bronchial glands which press on the vagus or on some of the branches of the pulmonary plexuses; various phases of phthisis and emphysema. Some observers have found the cause in spasm of the diaphragm and of the inspiratory muscles.

We come now to indirect causes; and here, as in practice generally, the previous history must be closely investigated. Patients who have suffered from malaria, whooping-cough, or measles may develop asthma. Heredity and family factors are potent; they have been traced in forty per cent. of asthmatics. Asthma may "run in families" whose nervous machinery is unstable; in such cases asthmatic attacks may alternate with neuralgia, and perhaps epilepsy. Heredity or family tendency may not develop asthma until late in life. The children of asthmatics oftentimes manifest symptoms during attacks of upper respiratory catarrh. Various toxic agents, when they exist in excess in the circulating blood, are provocative. The gouty, particularly as they advance in life, have asthmatic seizures alternating with joint affections. Syphilis also is causative, perhaps through the blood, perhaps by enlarging the bronchial glands.

Improper diet—sea food especially—and an overloaded stomach with constipation are very prone to induce seizures, which from this cause more frequently come on after late suppers. Kidney diseases may have asthma as an accompaniment, probably through the circulation of unexcreted toxic substances in the blood. Uterine and

ovarian affections may also induce asthma. There is an intimate connection between asthma and such skin diseases as eczema, urticaria, and psoriasis—no doubt by way of the circulation.

But when we come to the nervous system we find a factor fundamental in most cases of bronchial asthma; either the pneumogastric nerve or the vasomotor apparatus is disturbed; and thus are brought about the spasm of the muscular coats of the bronchi and the turgescence of the mucosa; thus do also such emotions as anger and fright bring on seizures. This explains why asthma, neuralgia, angina, and gastric symptoms alternate,—through irritation of the origins of the fifth and eighth pairs in the medulla, one organ and then another being affected.

Prognosis.—This is good as to life; the patient seldom dies during the seizure, however dreadful it appears. We have to consider whether we can remove the exciting cause. Then there is the age. A patient under fifteen with a well-formed chest, his seizures tending to diminish in frequency and intensity, his lungs free in the intervals, should do well; on the other hand, a middle-aged man, whose attacks increase progressively in number and in intensity, who suffers from wheezing and dyspnoea in the intervals, who is getting up a collateral emphysema, must be given an unfavorable prognosis.

Treatment.—The first thing we have to do is to relieve the seizure; and this is most effectively, though usually not wisely, done with a subcutaneous injection of morphine (gr. $\frac{1}{4}$). Chloroform or ether inhalations also give wonderful and prompt relief. Chloral hydrate may be given. Amyl nitrite "pearls" may be broken under the nostrils; and opium and belladonna suppositories may be used. Oxygen may be resorted to, or we may dry thoroughly and burn on a thin disk the following: Pulv. stramon. fol., \mathfrak{z} i; pulv. cascaril. cort., \mathfrak{z} ii; potassii nitrates, \mathfrak{z} ss; pulv. ipecac, \mathfrak{z} ss. Other sedatives are belladonna, henbane, cannabis indica, antimony, lobelia, stramonium, and the bromides. An enema may be necessary; and we may have to empty an overloaded stomach by a hypodermatic of apomorphine (gr. $\frac{1}{10}$). Hot alcoholic drinks may be in order; as also hot-water bottles to the extremities. As soon as possible we attend to elimination by the rectum, the kidneys, and the skin. A subcutaneous injection of

pilocarpine (gr. $\frac{1}{8}$) may be appropriate. Possibly even venesection may have to be considered. But there are few asthmatic seizures that will not yield to morphine (with atropine) as here first mentioned. After we have relieved the paroxysm, which has seemed so grave to the patient and his family, we seek the cause in order to prevent future spasms if possible. We treat all lesions of the upper air passages. We counsel against dust. Any one odor that has been found by experience to bring on the seizure is avoided. Various climates may have to be tried; one which is equable, fairly dry, of moderate altitude and fairly dust-free, will suit many cases, but not all. Often a climate the opposite of that to which the patient has been accustomed will relieve him; when the asthmatic has lived in a moist climate, a dry one may help him; the asthmatic who has lived inland may do well at the seashore. Oddly enough, the atmosphere of cities suits many asthmatics better than the purer rural air. Dampness in air or soil is generally unfavorable for asthmatics.

If we can, we cure bronchitis and other such pulmonary lesions as may induce or be contributory to asthma. The previous history is most exhaustively gone into; and every clue is followed, sometimes with most beneficent results. Such diseases as malaria, gout, syphilis, and kidney and skin affections should be treated.

When heredity predisposes we improve the general health; lung gymnastics are in order to develop the upper part of the chest and to correct the asthmatic stoop; we advise outdoor life, with walking, golf, or riding—stopping at the point of fatigue. Such exercises must not be perfunctory nor soon abandoned; it should become the life habit. The pneumatic cabinet has helped some cases. The body surface is kept warm, especially the extremities. Tepid baths are made customary. As to diet, the stomach should never be overloaded; light meals with some food between times; the dinner in the middle of the day, so that a nocturnal paroxysm may be averted. Restrict the carbohydrates and banish the lobster, the crab, and the deadly hot bread; plainly-cooked and easily digestible meats, fish, vegetables, and fruit are proper. Stimulants may be taken carefully if they be of established purity. Coffee is best taken black, with a little sugar, and preferably without milk or cream. As to medication: For the thickening of the bronchial walls and enlargements of the bronchial glands we persist in the use of iodide of sodium

or potassium (or both together) in ten- to twenty-grain doses *t. i. d.* Inunctions of substances containing iodine are to be used; there are mineral waters which contain iodine. Such a combination as the following may be indicated: \mathcal{R} Ext. quebracho, \mathfrak{Z} ii; tr. stramonii, \mathfrak{Z} ii; vin. antimon., \mathfrak{M} xviii; syr. grindel. rob., \mathfrak{Z} i; ext. senegæ fl., \mathfrak{Z} ii; syr. tolu., qs. ad \mathfrak{Z} iv. M. et sig.— \mathfrak{Z} i *t. i. d.* in water.

BRONCHIAL AND TRACHEAL STENOSIS.

Bronchial stenosis is a narrowing of bronchial lumina. The causation may be from within, through constriction by foreign bodies, new growths, inflammatory exudates, cicatrices of healed ulcers (generally syphilitic or tuberculous), or (in the smaller tubes) by swelling of the mucosa, or from without the bronchi through compression by enlargements involving the thoracic organs, such as aneurism, echinococcus, solid tumors, malignant growths, enlarged glands, thoracic abscesses, and extensive pleural effusion. The symptoms will be in proportion to the size of the bronchi and the degree of the stenosis. There is pain and dyspnœa; cough and expectoration may be present, also moderate fever. The physical signs: There are deficient respiratory movements on the affected side. Bronchial fremitus may be diminished, as also the breathing. The voice may indicate laryngeal involvement. In the diagnosis we consider affections antecedent to the bronchial stenosis. We eliminate laryngeal or tracheal stenosis by the laryngoscope. The prognosis is unfavorable. We treat the cause; we remove, if possible, foreign bodies (emetics may here be of assistance). We may be able to dilate by means of bougies, tubes, and the like.

Tracheal Stenosis.—This is, fortunately, rare. The history resembles that of bronchial stenosis. It may be caused by goitre, thoracic aneurism, new growths, or foreign bodies in the trachea. There is difficulty in respiration—dyspnœa and epigastric retraction. There are paroxysms of stridulous breathing, loud wheezing over the constricted area, with mucoid or blood-stained sputum, cough, retrosternal or substernal pain, soreness, and oppression. The bronchoscope has become wonderfully useful in the detection of bronchial and tracheal lesions, and in the application of medicaments through this tube.

PULMONARY ATELECTASIS.

This condition, called also pulmonary collapse, is directly the opposite of emphysema; the air is removed from the vesicles, disappearing largely by absorption. It occurs most frequently in the new-born, and is then due to defective respiration. There are likely to be congenital circulatory anomalies. Atelectasis acquired after birth occurs in three ways: (1) In pertussis and bronchopneumonia in children, there is a plugging of the smaller bronchi, with the products of inflammation; the air thus retained in the vesicles becomes absorbed, and atelectasis results. (2) Lung tissue may be compressed until its normal contractility has been overcome by pleural effusion, hydrothorax, pneumothorax, pericardial effusion, great cardiac hypertrophy, a solid tumor, an aneurism, possibly even abdominal growths, ascites, or meteorism. (3) Conditions that weaken and obstruct inspiration, such as certain brain affections, pneumogastric paralysis, and paralysis of the chest-walls, may induce atelectasis.

Pathology.—The affected areas sink in water; they present through the pleura a bluish-red tinge, and are brownish-red on cross-section. The cut surface is smooth and depressed below the level of the adjacent lung structure. The bronchi are occluded, but may be inflated by means of a blowpipe.

Symptoms.—This is a secondary condition, and the symptoms are veiled by those of the primary disease. Respiration is laborious and increased in frequency; the pulse may be small, rapid, and feeble; the surface of the body cool, moist, and clammy. Atelectasis in the new-born is evidenced by shallow, rapid breathing, lividity, cold extremities, a faint cry, drowsiness, motor irritation (twitching and convulsions).

Physical Signs.—Retraction during inspiration over the lower portion of the thorax; fremitus diminished; bronchial breathing if the area of atelectasis is large; the subcrepitant râles of bronchopneumonia may be present.

Diagnosis.—Atelectasis is distinguished from lobar pneumonia by the absence of the initial chill, fever, and pain of the latter, and by the characteristic inspiratory retraction of the lower portions of the chest in atelectasis. The flat note, varying in position, of pleu-

ris is with effusion is wanting in atelectasis. The prognosis is good when the area is small; serious when atelectasis is extensive. The outlook depends also on the associated disease.

Treatment.—Full inspiration at regular intervals; the patient should be taught to change his position frequently when lying down. Cold shower-baths may open up atelectic areas by reflex action; compressed air and pure oxygen are inhaled; tonics, nourishing diet, and the judicious use of stimulants are counselled; otherwise the treatment is that of the accompanying disease.

THE LUNGS IN THE HUNCHBACK

Pronounced spinal curvature (*kyphoscoliosis*, posterior and lateral curvature) causes aplasia, or defective development of the lungs. On autopsy the lung is small; there are areas of emphysema varied with areas of collapse. (The foramen ovale and the ductus Botalli may be found open when congenital atelectasis has kept up high pulmonary pressure.) The chest is more or less twisted on its own axis, is shortened in the vertical diameter, and immovable; thus lung expansion becomes impaired or impossible, and the respirations pronouncedly or entirely diaphragmatic. The breathing is labored; and upon great physical exertion there is urgent dyspnoea; the development of an ordinary bronchitis may speedily terminate fatally. The physical signs are those of localized emphysema, combined more or less with those of atelectasis. There is generally an extension of the cardiac dulness to the right, also evidence of cardiac dilatation, of right ventricular enlargement, and of failure of compensation. In treatment we caution the hunchback against excessive exertion, look after the heart, and order cardiac stimulants when compensation begins to fail.

ACTIVE CONGESTION

Active congestion or hyperæmia is rather a lesion than a disease; it is characterized by active "affluxion" or determination of blood to the pulmonary tissue. The causes which tend to pulmonary inflammation will also produce congestion that may mark the invasion of lobar pneumonia. The inhalation of irritants, extreme heat or cold, exposure, alcoholism, an overworked heart during vio-

lent mental excitement, may induce congestion; as also high atmospheric pressure, as in caissons and deep-sea diving, or from violent inspiratory effort while the trachea is closed, as in croup, laryngismus, or whooping-cough. Congestion may come about through destruction of the capillaries, occlusion of capillaries by emboli, or irregular capillary flow in one pulmonary area while vessels in adjacent tissues are reciprocally distended and engorged. Active congestion is most frequently associated with such pulmonary diseases as severe bronchitis, pleurisy, pneumonia, and tuberculosis. There may be collateral œdema from excessive blood-pressure. Suddenly suppressed menses may result in active pulmonary congestion.

Treatment.—A hot mustard foot-bath is given. A hot mustard poultice (not thick enough to impede respiration) may be placed over the affected area. Cupping may be required, and perhaps venesection. The extremities must be kept warm by hot-water bottles; active catharsis promoted by means of Epsom salt. If the heart valves are at fault, digitalis and strychnine may be essential; otherwise internal remedies are not effective in this condition. A small dose of opium may be given to relieve pain and anxiety. After the danger of death is passed, stimulative and supporting treatment is indicated—ammonium, camphor, and quinine. Alcohol is barred because it dilates the capillaries.

OBSTRUCTIVE CONGESTION

In obstructive or mechanical congestion or hyperæmia the blood cannot escape from the lungs to return to the heart. This lesion is known also as brown induration of the lungs, or the pneumonia of heart-disease. We have here to deal with a passive congestion, which may have been brought about by the pressure of an aneurism or tumor, but generally it is secondary to and a part of valvular heart-disease, especially mitral stenosis. It usually supervenes before middle life. The obstruction may be at the mitral valve, as in stenosis or regurgitation; or it may be in the dilated and imperfectly emptied left ventricle, as in advanced constrictive or regurgitant aortic disease. In any case, whether there is absolute narrowing (stenosis) of the blood-channel between the pulmonary and systemic circulations, or whether there is regurgitation

(so that each right ventricle contraction is met and opposed by a counter rush of blood from the left ventricle), the pulmonary circulation can proceed at increased pressure only by the more vigorous contractions of the right ventricle. Hyperæmia results from the damming back of the blood through the pulmonary veins; the elasticity of the lungs is impaired, and their vital capacity is diminished.

The *symptoms* supervene upon failing cardiac compensation. There is cough and evidence of bronchial catarrh; the sputum is frothy, contains pigmented desquamated epithelium, and is streaked with blood. There may be hæmoptysis of small, dark coagula. There is a sense either of lightness or oppression referred to the epigastrium. Indications of the cardiac lesion are dyspnœa, livid lips, palpitation, small and frequent pulse.

The *diagnosis* is made by the evidence of valvular disease, the crepitant râle, and the hæmoptysis. The *prognosis* rests upon the condition of the heart. If there is only mitral stenosis, the patient may live for years. Marked catarrhal complications and hæmoptysis are unfavorable.

The *treatment* is mainly that for the heart-disease; we avoid everything that tends to quicken respiration and to produce catarrhal inflammations. Violent and tumultuous heart action may require tincture of aconite (M-i-ij) every hour until there is relief. A feeble and dilated heart calls for digitalis and strychnine. If the heart acts well, a semi-recumbent position is satisfactory; but the patient should lie flat when an irregular and feeble pulse threatens syncope.

HYPOSTATIC CONGESTION

Hypostatic congestion, or hypostatic (basic) pneumonia, is a more or less complete stagnation of blood in the pulmonary tissues. This is also a passive congestion, and it depends upon one or more of three factors: (1) Failure of the heart, with inability to propel the blood through the pulmonary capillaries; (2) an altered condition of the blood, making difficult its passage through the capillaries; (3) the attraction of the blood by gravity to the most dependent parts. Thus we have this form of congestion in low or protracted fevers, as in typhoid relapses, in cerebral apoplexy, in prolonged coma, morphine poisoning, adynamic states, chronic tuberculosis or

cancer cachexia); also where, by weakness or inanition, there is prolonged maintenance of the recumbent posture without change of position. The effects of pressure from the abdomen (tumors, ascites, meteorism) upon the lung may induce this congestion. We fear it most after surgical operations, in extreme old age, toward the end of a prostrating illness, where the heart-beat is feeble, and in uræmic and icteric conditions. This is a very common mode of dying.

The *treatment* must be directed to the related condition. The position is changed from time to time. The patient should, if possible, be encouraged to take long inspirations. Good food and alcoholic stimulants are indicated for the failing powers. Nutritive enemata may be necessary. In all exhausting diseases we anticipate and, if possible, ward off this congestion by timely support and stimulation. Ammonia, ether, quinine, musk, camphor are drugs which will prove effective. Camphor in ether (1 in 8) may be given subcutaneously; or \mathcal{R} Pulv. camp., \mathfrak{zss} ; strych., gr. $\frac{1}{4}$; ft. caps., No. x. Sig.—One every three hours.

PULMONARY ŒDEMA

This is a hyperæmia with hydræmia; there is transudation of serum through the alveolar walls into the air-spaces. The œdema may be local, related to a circumscribed inflammatory lesion; or it may be general, and from causes which produce congestion. It may result when the flow of venous blood meets an obstacle which the force of the right ventricle cannot overcome; such an obstacle may be due to a paralyzed left ventricle. Other factors causing œdema are: the condition of the walls of the blood-vessels, which may be abnormally permeable; diluted blood-plasma and morbid state of the lungs; pressure upon pulmonary veins or upon the vagus nerves of the pulmonary plexus. Œdema may thus arise in connection with or be terminal to tuberculosis, pneumonia, emphysema, pulmonary infarct, abscess or gangrene; cerebral disease; angina pectoris; purpura and other hæmic diseases; albuminuria and chronic nephritis. It has accompanied acute ascending spinal paralysis. An angioneurotic œdema is reported; this comes on suddenly with gastralgia and vomiting; some hæmic irritant is considered to be the

cause of vasomotor paralysis with consequent dilatation of the blood-vessel and transudation.

Symptoms.—There is dyspnœa, sudden or gradual, proceeding to orthopnœa; the breathing is rapid and oppressed; there is cough, with watery, frothy, blood-tinged expectoration; there is an audible rattling in the throat. Local œdema (accompanying inflammation) will give fever; but in the general œdemas, as with chronic nephritis, there may be subnormal temperature.

Prognosis.—Death may supervene within an hour. From attacks of moderate severity there may be recovery. The circumscribed œdema (of inflammation) is not so dangerous to life.

In the *treatment* one must act quickly. Dry cupping is done over the lungs and kidneys, not so much to draw blood as to promote absorption. The posture must be changed from time to time. Applications are made to the chest—fomentations, turpentine stupes, mustard poultices. Venesection may be appropriate. Purgation and diuresis are essential. Oxygen inhalations may be effective. The drugs used are strophanthus, digitalis, juniper, caffeine, spirits of nitrous ether, ammonium acetate, alcohol, strychnine, nitroglycerin, adrenalin, atropine, camphor in ether (1 to 8), possibly pilocarpine. In treatment the causes of the œdema must be kept in mind.

PULMONARY APOPLEXY

Pulmonary apoplexy or hemorrhagic infarct is a localized extravasation of blood. It is due to an embolus or to a thrombosis of a branch of the pulmonary artery; sometimes there is a thrombosis of a distant vein. This form of apoplexy may supervene upon valvular disease (rheumatism). Infarcts are single or multiple; they are usually near the lung surface and in the lower lobes; they are wedge-shaped, dark-red, firm areas (walnut to orange in size), the bases being toward the periphery. If the surface of the lung has been reached the pleura will be inflamed. The vesicles are distended with red blood-cells. The lesions may subsequently be replaced by cicatricial tissue, or the blood may possibly be absorbed. An infection-bearing embolus will induce abscess or gangrene; the embolus is found in the artery supplying the region

involved. *Symptoms* may be absent; or there may be sudden severe pain, dyspnoea, chill and fever, and hæmoptysis.

Such physical signs as fremitus, dulness, bronchial breathing, and râles may be elicited. The *diagnosis* is made by the history, especially of valvular disease. We differentiate infarct from pneumonia by the milder general symptoms and hæmoptysis in the former, and by the pronounced physical signs in pneumonia. Infarct is rarely fatal, for either the circulation is generally reëstablished or fibrosis supervenes; there may, however, be grave sloughing and cavitation. The treatment is symptomatic. There should be absolute quiet, minimum diet, elimination, reduction of blood-pressure (nitrites); opium if necessary.

LOBAR PNEUMONIA

The treatment of lobar pneumonia pursued in the Bellevue, New York, Roosevelt, and Presbyterian Hospitals in New York City was thus epitomized by the late Dr. H. P. Loomis: On admission the patient is usually given calomel in small repeated doses, followed by a saline the next morning. Local applications to the chest are generally restricted in cases in which intense pain and distress are felt; such applications are not a routine practice. An exclusive milk diet, plain or modified, is adopted during the height of the disease. A temperature of even 104° is not regarded as an absolute indication for special treatment unless nervous symptoms (marked restlessness or delirium) accompany the fever. At the Presbyterian Hospital, when the temperature exceeds 104° , cold packs are applied to the chest anteriorly; in the New York Hospital alcohol sponging is resorted to and, failing that, the cold pack; at the Roosevelt Hospital alcoholic sponges or cold packs are given, and at Bellevue Hospital spongings with tepid water (80° to 85°). Only in the New York and the Presbyterian Hospitals are tub-baths given; and even then only in cases of toxæmic pyrexia or in alcoholics with marked nervous symptoms. Codeine is given to control cough (one-quarter to one grain every four hours); sometimes heroin (gr. $\frac{1}{6}$), and perhaps morphine. Trional and sulphonal are given for insomnia. Pulmonary œdema is treated by hypodermic injections of adrenalin; also by atropine, cupping, and stimulation.

The use of oxygen is restricted to cases of cyanosis and dyspnoea. The three cardiac stimulants are alcohol, strychnine, and digitalis; of these alcohol is most used and most relied upon. Digitalis is used in the Roosevelt. The indications for these stimulants naturally vary in different cases. Nitroglycerin is only occasionally used. In the Roosevelt rectal saline injections are given, especially for alcoholics, and when nutrition is failing; eight ounces of normal salt solution are introduced every four hours through a funnel attached to the end of a catheter; these injections are well retained, and seem to be of decided benefit.

In addition, one must ever consider elimination by bowels, kidneys, and skin, watch the heart (this is most imperative); give alcohol in alcoholic pneumonia; promote sleep as much as possible, avoiding the possibility of an œdema or a hypostasis; use oxygen, but earlier than usual; venesect in plethoric subjects, if this seems best; be sure to have a competent nurse.

THE NEWER MEDICINAL AND NON-MEDICINAL DIURETICS

BY THOMAS LINN, M.D.

Paris and Nice, France

At a recent Congress held at Lyons we were enabled to study the methods now in use to promote diuresis.

We find it necessary to prescribe diuretics for the auto-intoxication of chronic patients in acute diseases whenever it is necessary to eliminate toxic products, also in gout, rheumatism, neuralgia, enteric affections, skin diseases, headache, and all sorts of maladies.

As to the non-medicinal ones, it is often said that one will pass a great deal of urine if he drinks plenty of water. This statement is erroneous. It is most important to direct at what time water should be taken, as well as the quantity and kind of water to be used.

Large quantities of water, we know, burden the stomach, and in cases of arterial hypertension become harmful. We also know that plenty of water does not help œdema nor dropsy. Professor Gilbert has demonstrated that in hepatic cases copious draughts of water cause oliguria, and Courtel proved that when the kidneys are disordered they sometimes cause almost complete suppression of urine.

At Evian-les-Bains and other water cures they now use only a quart or two of water where they formerly used great quantities; but they insist on its being taken during the morning hours, if possible before rising. Very little is given during the afternoon.

Dr. Arnozan proposed the following rule for the use of water: Give only as much water as the amount of urine the person is in the habit of passing; then, after observing the permeability of the kidneys, increase slowly.

After many experiments Dr. Marcel Labbé proved that water is eliminated more rapidly when taken apart from meals than when taken at meals, and Potain taught that we should never give anything with milk if we wish to obtain its maximum diuretic effect. This is also true of water.

Whey, white wine, cider, and coffee are all diuretics; a maceration of green coffee seems to be exceedingly diuretic, and is without the bad effect on the nerves that ordinary coffee has.

Dr. Etienne seems to have elucidated the cause of the diuretic effect produced by lime waters. This, he says, is due to calcification, as shown by the great deposit of chalk found in the urine.

The food diuretics, grapes, melons, and other fruits, contain a large quantity of water, and are rich in grape sugar and alkaline salts. When given with a milk diet fresh fruits are very useful to promote diuresis. The same diuretic result is reached by giving the patient on milk diet less milk, and adding fruits; as milk contains too much sodium chloride and is not rich enough in hydrocarbons. This form of treatment has given excellent results in nephritis.

As to vegetables, asparagus is almost a medicinal diuretic; it seems to act by means of the salts of potassium and asparagine which it contains, but it should be stopped, however, when it ceases to give its characteristic odor to the urine.

Cutaneous irritation seems to act in various ways. Baths, for instance, favor diuresis even if they do not produce copious sweating; Professor Mayor, of Geneva, claims that they should not be used in nephritis if they cause sweating, as they only increase the labor of the kidneys.

Sulphur baths, also alkaline and particularly carbonic acid gas baths, have a strong diuretic effect, and thoroughly eliminate the chlorides and urotoxins.

Revulsion with poultices, plasters, cupping and friction with all the usual liniments, act by decongesting the kidneys. A formula for a liniment follows:

R	Tincture of digitalis	Grammes x
	Tincture of colchicum (root)	Grammes x
	Tincture of squills	Grammes x
	Camphorated oil	Grammes xii
	Ammonia aqua	Grammes vi

M. et S.—Rub on the upper lumbar region.

Cold douches act very well, but great care must be taken to know that the patient reacts. Patients with Bright's disease are very sensitive to cold, and rarely bear cold hydrotherapy. Colonic flushing may be useful because of the absorption of the water, and is

advisable in certain cases. Any nervous strain, overwork, taking cold, and coitus (the last by fatigue) may produce oliguria.

Linossir and others assert that in cases of actual suppression or lessening of the amount of urine the best method is to put the patient to bed. It is a curious fact that the erect position will keep up the difficulty. In all persons of a certain age, there is more or less renal sclerosis, and the best rule is the old one—bed and milk!

Drug Treatment.—Physiological diuretics seem to be the future of this treatment. At the Lyons Medical Congress Professor Chevalier said: "The kidney should be regarded as a continuous secreting gland; it has an elective function that is excited by the products secreted by itself." He found that, in the process of disintegrating, the albuminoid molecule gives off urea. Pouchet demonstrated that glycol and its ethers, the xanthic bases, etc., have considerable diuretic action. In some cases renal serum has produced a diuresis of eight to ten quarts. Dr. Thevinot found that injections of a serum taken from the renal vein had a highly diuretic effect. In some of the cases reported the diuresis increased from one to three pints, and in one instance to three quarts; this continued for three weeks. The general condition improved, and the uræmic symptoms disappeared, even in cases where the amount of urine voided was only slightly increased.

At this Congress Professor Gilbert advised the employment of liver opotherapy in hepatic cases. In cardiac oliguria and liver cirrhosis, when diet and medicines were of no avail, he was able to increase the diuresis by using hepatic opotherapy. In severe cases this method seems to promise much in the future, although it will take time to perfect it.

As to real drug diuretics, Professor A. Chauffard presented the most original communication at the Lyons Congress when describing a new diuretic, which is formed in the organism by synthesis. It is produced by giving theobromine followed by salicylate of sodium.

When the urine is found to remain at about 1500 after a patient has been taking theobromine in doses of one gramme or more per day, we add to it two or three grammes of salicylate of sodium and on the following day find the urine increased to 2500 or 3000; in one case it was even 6000. The theobromine is usually given in the morning, and the salicylate of sodium in the afternoon. This increase

persists for only a few days. After a few days of rest the test may be repeated. In order to see what therapeutic results can be obtained, a study is being made of this curious reaction of one drug upon another; this one of theobromine and sodium seems to be a definite measure to be resorted to in many cases where a diuretic is needed.

Nobecourt and Pasteau are using very small doses of theobromine and digitaline for children; as a rule, the doses formerly given must have been too large, for good results have been obtained from very small ones. It would seem that 0.4 gramme (6 grains) of theobromine is just as effective as one gramme (15 grains).

The older and more regular drugs are still used, but among the newer remedies is the *Viscum album*, or mistletoe, of which the French druggists have lately been making a specialty. Professor Pouchet has studied its diuretic effect, and found it to be due to a hypotensive action and to its saponaceous constituents, or saponines, as he calls them. In many cases its cardiovascular and diuretic action is strongly marked; it relieves albuminuria and seems to eliminate the chlorides. When taken in large doses it causes intestinal irritation and diarrhoea, like squills, but is rapidly eliminated.

The dosage is 0.10 to 0.15 gramme ($1\frac{1}{2}$ to 2 grains) of the cold aqueous extract to be given during the twenty-four hours. Theocine and adonis vernalis were also studied at this Congress, although their action is well known.

Dr. G. Vitry, of Paris, presented calcium chloride, stating that it has an excellent diuretic effect and is useful in eliminating the chlorides. It was given in cases of obesity with cardiac disease in doses of 0.5 gramme ($7\frac{1}{2}$ grains) per day for seven days with a result as follows: A diminution in weight of over three pounds; an increase in the amount of urine from one to two or even three quarts, and a chloride discharge of 13 to 15 or 16 grammes instead of six grammes as at first. This persisted for several days after the drug was discontinued.

As this Congress seems to have determined the present therapeutical value of all the newer forms of diuretics now in use, we hasten to report its conclusions.

HYPOCHLORHYDRIA AND ITS TREATMENT

BY J. CASTAIGNE, M.D.

Paris, France

GASTRIC pathology seems to be constantly changing, but the changes are less radical than formerly; still, with each new form of therapeutics new methods lead to modifications in its classification.

For instance, radiology has enabled us to study the gastric motions more accurately, and, to a certain extent, has superseded chemical treatment, although the latter is by no means abolished.

There are cases where chemical derangement follows if the stomach is not evacuated properly, and others where stasis has been induced by hyperacidity; but in neither case can we ignore the chemical nor motor disturbance, but must treat both.

Hyperacidity, called hypersthenia by Professor Robin, is still most prominent among the chemical types of dyspepsia. We now know that a patient with only a slight increase of hydrochloric acid may show signs of hyperacidity; others may have a quantity of acid, and little, if any, stomach affection. There are still a vast number of cases of morbid clinical type characterized by acute pain coming on after taking food, and this pain is relieved by alkaline medication. In this article we wish to speak principally of the therapeutics of this condition, and consider the progress recently made.

Chemical Diagnosis.—Sahli was the first to propose that the patient be induced to swallow a little rubber bag, closed with catgut, and containing a pill of methylene blue. Then Meunier substituted for the blue (which had to be sought in the urine hour by hour) a little pearl of ether which, when broken in the stomach, made a strong taste of ether perceptible to the patient, thus showing the moment of highest acidity. But many physicians could not detect much difference between those having normal acidity and those with hyperacidity.

Fuld then made the observation that if, after giving bicarbonate

of sodium, the stethoscope was used on the stomach, a crackling sound was heard, which became louder and stronger when the acidity was abnormal. On percussion, too, when great acidity was present, a certain very acute sound was obtained. It is important to make the patient keep his mouth closed.

This method, carefully carried out according to Fuld's rules, and with the proper dose of sodium, has proved to be excellent. There is no important addition to treatment by chemical analysis,—passing a stomach-tube, and extracting the gastric contents, after proper diet for this purpose. This method continues to be used with profit.

As to etiology and its influence on the treatment of hyperchlorhydria, little is to be gained by the knowledge that there had been a number of dyspeptics in some of these families. Tuberculosis also is found in many of these cases.

It is necessary to look into this question of cause, as quite a number of dyspeptics suffer from certain faults in alimentation. These are the rapid eaters, the overeaters, those who are addicted to drugs, others who live in close air in cities. If the physician will study and remove these causes he will find his treatment beneficial.

Regimen.—Milk, with perhaps an addition of dry biscuits to increase its nutritive value, is still the favorite diet in acute cases. Old-fashioned lime-water, Vichy, and other bicarbonate of sodium waters still hold their place. Lab ferment, which has some advantages in promoting coagulation of milk, is, more or less, the basis of the whole series of preparations that have been invented as aids to the digestion of milk. It is necessary to tell these patients to “eat” their milk, not to drink it down quickly.

When other foods can be borne, they must be prepared, without modern sauces and spices, and all fried food must be eliminated from the dietary.

We will not dwell upon the nature of the foods to be used, as we are still discussing the value of meat foods *versus* vegetables. While meat digests easily in acid stomachs, it can only be allowed as plain roast without sauce. Vegetables supply the alkaline basis, and can be eaten plentifully; to a certain extent they replace bread and cake, which should be forbidden. Biscuits may be allowed in cases that are not constipated. Rice does not cause acidity, and has a high food value, so it may be taken in abundance. Potatoes are

alkaline, as are also macaroni and vermicelli: the two last mentioned should be strictly fresh. Cooked salad, artichokes, carrots, and cauliflower are all alkaline, and useful to prevent overeating. Even when given in purées or mashed, the dried peas, beans, lentils, etc., are hard to digest, and, like many of the true starchy foods, should be omitted from the diet in acidity. All the vegetables should be simply boiled and fresh butter added after cooking. Fruits are best cooked. Many of the new forms of malted food, which add the hydrocarbons in a digestible form, are a valuable addition to the diet, in some of these cases.

Fats.—This form of food is very valuable, and is considered to lower the amount of hydrochloric acid formed as well as the gastric secretion; therefore, fats should be largely used, provided the liver functionates correctly. The best fats are as follows: Fresh butter, cream, olive oil; almond milk is also recommended, and bread made of almond flour. If the patient digests fats easily we often give teaspoonfuls to tablespoonfuls of olive oil the first thing in the morning.

Drugs.—The burning sensation in the stomach, of which these patients complain, is quickly relieved by bicarbonate of sodium. Binet has shown recently that it is an excitomotor, and brings about the evacuation of the stomach. Unfortunately, it also has a latent action of excitosecretion, and then causes the trouble that it before helped. These patients gradually take more and more of it, until they reach enormous doses, which, Widal tells us, are injurious to the circulation. He found œdema caused by taking large doses of soda. Clement also reported a case in which a dyspeptic had swelling of the legs from the same cause.

This has led to the administration of other alkalines, and compound formulas are used, such as the following by Professor Robin:

R Magnesiæ hydrat., 30 centigrammes
 Bismuth subcarb., 50 centigrammes
 Prepared chalk, 50 centigrammes
 Sodii bicarb., 30 centigrammes
 Morphine hydrochlor., .0005 centigramme
 S.—One powder.

These powders are given when the acidity is felt some time after taking food, and may be repeated once if needed; if desired, this formula can be prepared as a liquid.

Professor Bourget, of Lausanne, gives his well-known formula:

R Sodii bicarb., 8 parts
Sodii sulphate, 2 parts
Sodii phosphate, 4 parts

This powder is dissolved in a quart of water, and three or more glassfuls are taken daily, one hour and a half after food.

Subnitrate of bismuth is not only useful to promote cicatrization of ulcers of the stomach, but, by its analgesic action and its prevention of acid secretion, also is invaluable in hyperacidity; the action first mentioned is due to the abundant secretion of mucus which it induces and the second to the nitric acid it gives off and its inhibition of the acid secretion. We have observed lately that the extensive use of this chemical in making radiographs has been responsible for some serious accidents, therefore, although not as active, we are using carbonate of bismuth in place of the subnitrate. Lion recently advised the use of the neutral salt of subnitric bibasic bismuth. We give it in the morning only, the dose being 10 to 20 grammes suspended in 200 grammes of water. We find that the bismuth is diffused over the mucous membrane no matter what the patient's position, therefore we see no necessity to make the patient assume, as some authors advise, any special position. Other sedatives may be used when vomiting is a symptom. Dr. Robin suggests the following list of tinctures which may be given before each meal, in dose of twelve drops in a little water: Tincture of menispermum cocculus, veratrum viride, opium, or belladonna and anise seed, in equal quantities.

In 1908, Petri demonstrated that oxygen water diminishes hydrochloric acid in such a manner that in some cases there seemed to be little or no acid left. This fact led to the use of it in all cases that resist other treatment. There seems to be no contra-indication, but care must be taken to use it in such a form that it will not cause the bottles to explode, as was the case with syphons that were filled by a company which had injected gas into the bottles, and these, when brought into very cold rooms, exploded.

Goodman gives one to two teaspoonfuls of pure oxygen water in a glass of water at each meal. Poly administers a glassful of such a solution one-half strength before taking food in the morning.

The treatment by dechlorination seems to be proving very useful. Pastre finds that there is a parallel in animals between the richness of chlorides in food and the amount of hydrochloric acid produced.

The acid secretion can almost be made to cease if we lower the amount of chlorides. Recent writers are of the opinion that, when salt is increased or forbidden, there may be a difference in quality rather than in quantity. For a time, when using this form of treatment, we find it necessary to wash out the stomach daily.

Hygiene.—It is absolutely necessary for the patient to understand that he must eat in perfect peace and quiet. The busy man must forget his anxieties and the mother for a time lay aside the care of her children and house.

Although sleep is not necessary, perfect rest for 15 minutes before each meal, and a half hour after, is recommended. A strong point is that the food should be cut into very small portions and well masticated, starchy foods even longer than meats.

Neither massage nor electricity will do good in these cases; sometimes a hot-air douche to the abdomen seems beneficial. Priestnitz compresses are excellent, and may be recommended.

Surgical interference is indicated only in those cases where there is an ulcer, and the surgeon can perform gastro-enterostomy.

In conclusion, the treatment of hyperacidity should be outlined as follows: Commence with an alkaline treatment, to which the tincture of belladonna, etc., may be added, as needed, then the hypochloride system. If the case does not improve, substitute bismuth for the sodium, and continue the no-salt and sedatives.

TREATMENT OF THE COMMON VEGETABLE PARASITIC DISEASES OF THE SKIN

BY FRANK CROZER KNOWLES, M.D.

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SINCE the epoch-making investigations of Sabouraud into the parasitology of the scalp ringworm, the exact microscopical and cultural differentiation of this disease has become exceedingly complicated. Clinically, however, the diagnosis of ringworm of the scalp remains, in most cases, quite an easy matter. Before discussing the treatment of this disease, it would be well to mention a few of its salient points, particularly in regard to its differentiation from alopecia areata.

Those who observe comparatively few of these scalp ringworm cases may erroneously look for the disease in adult life. Ringworm of the scalp in the adult, or in those older than fifteen years, is one of the rarest dermatological observations. Other conditions might be mentioned as resembling somewhat or slightly ringworm of the scalp; but, as the present article relates to treatment, it will suffice to differentiate, in a table, those two diseases which resemble each other most markedly,—tinea tonsurans (ringworm of the scalp) and alopecia areata.

Ringworm of the Scalp

Occurs before the age of puberty.
Attacked area only partially bald.
Hair loss more or less gradual.

Hair-follicles unusually prominent
("goose-flesh" appearance).
Broken-off hairs in or on the border of
the patch.
Area of attack usually scaly.
Hairs in patch pull out easily.

Microscopical examination shows
fungus.

Alopecia Areata

More apt to develop after puberty.
Attacked area entirely bald.
Hair loss usually sudden or fairly
rapid.
Hair-follicles less prominent or ob-
literated.
No broken-off hairs.

No scale on the attacked area.
Hairs on border of patch firmly at-
tached.
Microscopical examination shows no
fungus.

In a small proportion of cases the ringworm may be of a very inflammatory type, resembling closely an abscess. If broken-off hairs at the border of the patch, prominence of the surrounding follicles, the presence of the fungus, consisting of round, glistening bodies (spores) and red-shaped organisms (mycelia), are looked for, and the history elicited, the case offers no difficulty in diagnosis.

It is a well-known fact that ringworm of the scalp is one of the most refractory conditions that the dermatologist or the general practitioner is asked to cure. No clime is apparently free from this disease, which in the past, particularly in England and France, has assumed the proportion of a veritable scourge. The average time formerly required for the elimination of the ringworm fungus of the scalp was nine months. Since the newest method of treatment, the X-ray, has been instituted, a cure can be effected in the large majority of cases in approximately three months. So numerous were scalp ringworm cases formerly in England and France that ringworm schools were founded in order to limit the disease, more or less by segregation, and by the supervision of careful and systematic treatment to hasten the cure. Even under those improved conditions it often required fully nine months to destroy the fungus, located deeply in the hair-follicle, and to eradicate the disease. Since the institution of Röntgen therapy, as mentioned above, the cure of the affection has been hastened by almost six months. This new therapeutic agent has proved a boon, not only in England and France, where the disease has been so markedly prevalent, but also in our own cities and towns.

Depilation with the Röntgen rays has to be performed with extreme care, for the exposure must be of just sufficient length and power to produce hair-fall without causing too marked an erythema or a burn. Sabouraud, in order to safeguard this depilatory process, instituted the use of pastils impregnated with an emulsion of platinoeyanide of barium to regulate the dosage. These pastils are placed the same distance away from the X-ray tube as is the patient's scalp; when a sufficient quantity of rays have acted upon these tablets to change the color from a yellow to an orange-yellow, the scalp has been sufficiently "röntgenized" to cause depilation. One exposure by this method will usually make the hair fall. Only the area treated should be exposed, the remainder of the

scalp being carefully protected by lead foil. The spot treated should be outlined in ink, in order to prevent any overlapping of the treatment in the event of there being several patches. The radiochromometer of Benoist has been used in testing the quality of the rays.

Unfortunately, the pastils devised by Sabouraud and used so successfully by him and by Noire in Paris have not worked so accurately in this country, apparently because of a difference in atmospheric conditions. The personal element, therefore, governs greatly the result in the treatment of this disease. If the physician knows his tube, whether hard, medium, or soft, the approximate strength of his current, and whether or not the patient has any idiosyncrasy to the Röntgen rays, the depilatory process can be made quite simple. A self-regulating tube, slightly softer than medium,—in other words, a tube of a yellowish-orange light with now and then a tinge of blue, and containing considerable oxygen,—is placed between six and eight inches from the area to be treated, and the Röntgen machine, with a voltage between eight and ten, is allowed to run for fifteen minutes. This produces the depilation desired. It should be emphasized that great care must be exercised in order to prevent any possibility of burning and, therefore, permanent baldness.

It may not be feasible to treat ringworm of the scalp with the Röntgen rays, and therefore the older and slower methods must be resorted to. In all cases of ringworm of the scalp it is a wise precaution to shave all of the hair from the scalp, or at least to remove the hair from the patch or patches and immediately surrounding areas. The child should wear constantly a tightly-fitting cap made from muslin or some other easily-boiled material. The scalp should be washed once or twice with warm water and a mild soap, such as Castile, and should be shaved every week or two. As the hair grows into the infected areas after shaving, all the loose ones should be depilated, a dozen or more daily, with forceps, the latter being carefully sterilized after each depilation. The patient should use individual towels, combs, brushes, and soap, and under no circumstances let any article belonging to another child touch the affected areas.

As the hair on the general scalp is now kept closely shaved and scrupulously clean, and the loose hairs in the ringworm patch have been removed, we will consider the therapeutic preparations which

have been commonly used, and those which have proved the most beneficial. A thin base should always be used on a hairy part, even if the hairs are kept closely shaved. The bases usually prescribed consist of benzoated lard, cold cream, petrolatum, lanolin, and, because of its highly penetrating power, goose grease. The oily bases are olive and sweet oils, liquid petrolatum, and oil of sweet almonds. The liquid vehicles are water, camphor water, witch-hazel, and alcohol.

Numerous ingredients have been mentioned for application in the various bases suggested, and the following remedies have all proved valuable in this stubborn affection: precipitated sulphur, the various tar compounds, oil of cade, the official tar ointment (ung. picis liq.), liquor carbonis detergens (a mixture of coal-tar and tincture of soap bark), ammoniated mercury, calomel, bichloride of mercury, the tincture of iodine, the crystals of iodine, salicylic acid, and chrysarobin.

These preparations should be thoroughly rubbed in with the fingers, protected by cotton or rubber gloves, or with a brush. Applications should be at least twice daily, and each patch should be manipulated for five minutes.

Precipitated sulphur is used in the strength of from thirty grains to one and one-half drachms to the ounce. Oil of cade should be made up in olive oil, one drachm to the ounce, and, in certain cases, even the full strength of the official preparation can be used without causing irritation. Official tar ointment is used at first in the strength of one drachm to the ounce of one of the thin ointment bases, and increased, as the patient's skin can stand it, up to its undiluted formula. Liquor carbonis detergens is applied in the strength of one drachm to an ounce of water, or may be made up in one of the ointment bases. As the latter preparation is quite soluble, any one of the watery preparations will hold it in solution. Liquor carbonis detergens also may be increased in strength and, if it produce no irritation, the full strength may be employed. Ammoniated mercury or calomel should be used in an ointment, and is usually prescribed one-half drachm to a drachm to the ounce. The bichloride of mercury, made up in water or in one of the watery compounds, is prescribed in the strength of one-quarter to one-half grain

to the ounce. The tincture of iodine is used in its full official strength or diluted as required in water.

Salicylic acid is used to increase the strength and stimulating power of various other preparations rather than alone. This acid is given on a somewhat sliding scale, according to the irritability or resistance of the scalp, approximately from ten grains to a drachm to the ounce, the former strength being more frequently used. As salicylic acid is quite insoluble, particularly in water, it should be employed in alcohol or the ointment bases; the salicylate of sodium in a watery or alcoholic solution is preferable because of its solubility, but it is only about one-half as strong and not so effective as salicylic acid.

The two preparations which are probably the most efficacious in this disease, but which must be used with care, are iodine, a drachm of crystals made up in one ounce of goose grease, and, the other, chrysarobin, ten to thirty grains, salicylic acid, ten to thirty grains to the ounce of lanolin. The iodine preparation is applied thoroughly twice daily with a stout brush. The chrysarobin prescription must be employed most cautiously to prevent any irritation of the surrounding parts, particularly guarding against its getting into the eye; it should be thoroughly rubbed into the patch, for at least five minutes night and morning, the manipulator wearing a thick rubber glove. The writer has had the best results with the latter preparation, the next best with the iodine crystals. The Röntgen therapy is by all means the method of choice.

The inflammatory ringworm cases should be treated with much milder remedies than the indolent non-inflammatory type. In this kerion, abscess-like outbreak lotions act exceedingly well, particularly ichthyol lotion, one-half drachm to two drachms to an ounce of water, or the hyposulphite of soda, one-half to one drachm to an ounce of water, or witch-hazel. The ointments which prove most efficacious in this type of lesion are precipitated sulphur, one-half drachm to an ounce of petrolatum, and, if much pustulation is present, ammoniated mercury, twenty grains to one-half ounce each of lanolin and petrolatum.

Tinea sycosis, or ringworm of the bearded region, is usually of very inflammatory type, and must be distinguished from multiple abscesses, non-parasitic sycosis or sycosis vulgaris, and impetigo con-

tagiosa. There should be very little difficulty in the diagnosis if a few differentiating points are recalled, such as the very inflammatory, carbuncular-like lesions; the eruption usually limited to the bearded region to the exclusion of the mustache area; the partial hair-fall, the broken-off stumps, the loosening of the hair in the follicle, the rapid onset, and the presence of fungus. This complex of phenomena makes a clear picture of tinea of the bearded region.

Ringworm of the beard is much more readily cured than tinea involving the scalp, as Nature helps materially by the severe inflammatory reaction which loosens the hairs in the hair-follicles and thus throws off the disease. Milder remedies are employed than in the non-inflammatory type involving the scalp. In very inflammatory cases large, fluctuating boggy masses appear in the greater part of the bearded region; under no circumstances should these areas be incised. Dressings kept continuously wet with a saturated solution of boric acid, perhaps with the addition of hyposulphite of sodium, one-half drachm to the fluidounce, or a solution of ichthyol, one-half to two drachms to the fluidounce of water, work admirably. Ointments in fairly mild strengths also prove readily curative, such as precipitated sulphur, one-half drachm to the ounce of petrolatum, or ammoniated mercury, twenty to thirty grains to the ounce of benzoated lard. The patient is frequently so disfigured by the disease that a few days' stay at home is compulsory, and the continued wet dressings hasten the cure. The person afflicted should be extremely careful to see that nothing touching the diseased areas is used by any one else.

Tinea circinata, or ringworm of the skin surface, should be easily distinguished by its circular shape, the slightly-raised border, the pinkish-red circumference, its pinkish-yellow centre showing a fine scale, the distribution (usually on the neck and arms), frequently one patch only being present, and usually not more than three or four; and—to clinch the diagnosis—microscopical examination reveals the fungus. If the fungus is not sought, and several areas of tinea are present, a differentiation must be made from pityriasis rosea, annular and macular syphilis, psoriasis, and seborrhœic eczema.

The cure of tinea circinata is a simple procedure, and several drugs prove efficacious. Tincture of iodine may be painted on the affected patch twice daily; but, as a great majority of our cases

develop in childhood, this preparation is apt to irritate the tender skin. Precipitated sulphur will rapidly effect a cure in these cases, and does not produce the irritation that the iodine compound does, therefore is preferable. It is probably better to use the sulphur in a thick base so that it will be constantly in contact with the ringworm. A good formula consists of precipitated sulphur, one-half drachm, powdered starch and powdered zinc oxide, each two drachms, and petrolatum, one-half ounce. The substitution of powdered bismuth subcarbonate instead of the zinc oxide makes a smoother base. This preparation cannot be washed off, because of the starch, but the surface can be readily cleansed by petrolatum, olive, or sweet oil. This base should be applied three or four times daily, first removing the old by one of the methods above mentioned before applying the new. If a thin ointment base is used, such as petrolatum, it should be thoroughly rubbed into the lesion at every application. If the starch is omitted from the ointment base, water will remove it. The surface treated should be covered with a thin layer of surgical gauze or a clean piece of old muslin or linen. The ringworm should be cleansed each night and morning with a mild soap and warm water. Other drugs also may prove curative, such as ammoniated mercury or calomel, one-half drachm to the ounce; one of the tar preparations mentioned under the treatment of scalp ringworm, in the strength of one-half drachm to the ounce; and iodine crystals, fifteen grains to one-half drachm to the ounce of goose grease. But as sulphur is remarkably efficacious in the cure of ringworm of the skin surface it is usually unnecessary to seek farther.

Tinea cruris, the so-called *eczema marginatum*, or ringworm involving the axillæ, the pubic region, the inner surface of the upper thighs, and the gluteal cleft, has practically the same clinical appearance as ringworm of the general skin surface, the picture, however, being somewhat altered by the moisture of the areas attacked. The sharp margination of the patch offers its chief clinical differentiation from squamous eczema, and the presence of fungus conclusively proves the diagnosis.

The two preparations most strongly recommended in the treatment of this affection are solution of the hyposulphite of sodium, one-half drachm to the fluidounce of water, and precipitated sulphur,

one-half drachm to the ounce of petrolatum. If the hyposulphite solution proves too drying, ten to fifteen minims of glycerine may be added to each fluidounce. If greater penetration of the ointment base is required because of the depth of the ringworm, equal parts of lanolin and petrolatum or of goose grease may be employed. These ringworms may be quite inflamed by the moisture and friction of the parts involved, and the strength of the germicidal drugs must then be reduced. If the patches are quite refractory to treatment an effective means of cure consists in the use of two different solutions: the first made up of the hyposulphite of sodium, one-half drachm to the fluidounce of water, and the second of glacial acetic acid, twenty minims to the fluidounce of water, the second being applied before the first has become dry.

Tinea versicolor is a disease of the skin characterized by the development of brownish-yellow and slight scaly spots upon the chest, the back, and the abdomen. These patches have been termed erroneously by numerous general practitioners "liver spots." The disorder is in no way related to the liver, and is caused by a vegetable fungus attacking the skin. It must be chiefly distinguished from seborrhœic eczema, pityriasis rosea, and macular syphilis. The affection is quite readily cured, but it shows a tendency to recur because the underclothing is not properly or insufficiently disinfected. Every article of clothing that touches the infected areas should be boiled for a full hour during the washing process. The remedies which promote rapid recovery from the affection are precipitated sulphur, one drachm to one-half ounce each of lanolin and benzoated lard, or the hyposulphite of sodium, one drachm to the fluidounce of water. The various tar compounds and the bichloride of mercury have been employed, the former in the strength of one-half to one drachm to the ounce of one of the thin ointment bases and the latter one-quarter to one-half grain to the fluidounce of water. None of these has proven so rapidly curative as the hyposulphite of sodium. It would be well to start the treatment with a warm bath and plenty of Castile or boracic acid soap, and, after the body has been thoroughly dried, to saturate the affected areas with the solution, or rub in the ointment. Both bath and medication should be employed twice daily, night and morning.

Medicine

GASTRO-INTESTINAL TOXÆMIA

ITS CAUSE AND TREATMENT: WITH A CRITICISM OF INTESTINAL STASIS (LANE)

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IN taking part in a recent debate at the Royal Society of Medicine, I gave my personal views and experiences of the causes, symptoms, and treatment of gastro-intestinal toxæmia. These are now embodied in the following article.

Granted the exact nature of the toxins is not known, nor even the identity of the bacteria evolving them in any specific case, what of that? If the bacteria exist in the digestive tract, if they evolve toxins which produce symptoms, where and how they arise and how best to deal with them is the important matter. What of syphilis and malaria? Were they not treated empirically and successfully, the spirochæte, plasmodium, and their toxins being quite unknown? What of scarlet fever and measles? We know less of their causes than we do of those of intestinal toxæmia, and until recently the same held true of infantile paralysis. Yet these are grave lesions and all gain admission to the body by the common nasopharyngeal tract (Flexner).

In this discussion one has heard repeatedly the statement that "in the normal" so and so occurs. Now, personally, I am convinced that so widespread is gastro-intestinal and other infection that it is exceedingly hard to find a normal person, and therefore to ascertain what the *standard* is, both of digestion and the rate of progress of the intestinal contents. Still more difficult is it to learn which are the so-called *normal* intestinal flora. We can but deal with averages, and herein lies the possibility of a variety of *interpretations* of the data available in any specific instance.

WE MAY APTLY COMPARE THE GASTRO-INTESTINAL TRACT WITH AN
OPERATION WOUND

We know with regard to that least septic of all traumatic surface lesions—an operation wound—that it heals kindly and without inflammatory symptoms, not because we have successfully excluded *all* bacteria from its depths, so rendering it quite aseptic, but because only a few, and those usually not very virulent, bacteria have gained admission to the tissues. We also know that the infection is a *single dose*, by which I mean that the depths of the tissue are not infected day by day, *i.e., repeatedly*: the *importance of such reinfection* is readily seen with regard to operation wounds, for, if we open up such wounds every day for seven to ten days, gross infection is inevitable, and some degree of suppuration results.

LET US APPLY THIS TO THE GASTRO-INTESTINAL TRACT

It is practically impossible to prevent micro-organisms from the mother's skin and mammary ducts gaining access to the mouths and stomachs of breast-fed children; hence infection by skin germs is inevitable, and so far as this is inevitable we may regard them as the natural bacterial flora of the healthy child's mouth and stomach (what these germs are I am not competent to state). Not that I believe *any* intestinal bacteria are of benefit to us or necessary; they are merely inevitable.

But the germs on the skin and in the mammary ducts of a *cleanly* mother's breast ought to be mild in virulence and few in number, and under such conditions the much-vaunted power of the acid gastric juice might efficiently protect the *intestine* by destroying such few and mild germs as are presented to it; hence, normally, the intestine should be sterile.

We know, however, that the *quality* of the gastric juice varies greatly according to the nature of the food presented for digestion; often it is free from hydrochloric acid and consists chiefly of mucus; therefore, sooner or later, probably about weaning time—when disturbances of digestion are prone to occur—some germs are only too likely to pass through the stomach and invade the intestine. In a healthy child this infection is relatively mild in degree and virulence, particularly if it is not often repeated.

These gastro-intestinal tracts may be likened to *aseptic wounds* and considered healthy tracts; in them the mucosæ do not absorb *any* food toxins, and but little bacterial toxins.

SEPTIC CHILDREN

But if the mother has not taken preliminary care of her nipples, and if she develops cracked nipples or eczema, is dirty in her person, does not cleanse the child's mouth after every nursing, and so on, it is obvious that more numerous and virulent bacteria will pass into the child's mouth and stomach, and in such cases irritation of the mucosæ occurs; that is, *gastritis*. In *gastritis* excess of mucus is secreted, which is in no way inhibitant to bacteria, but, indeed, serves as a vehicle to protect and convey them into the bowel: hence early infection and reinfection occur continuously. These bacteria are of increased virulence, and may differ in nature from those found in what I have called healthy intestines.

When we supplement by the above sources of infection thumb-sucking, dirty teats, and so on, including milk itself, as cow's milk under the best of conditions teems with germs (Savage), *we may aptly compare the intestine of these cases with suppurating wounds; i.e., those in which repeated infection has occurred.* Can it be said of these two examples that the flora in the intestine of the hygienically-reared child is identical with that of the one suckled from cracked and suppurating and dirty nipples, etc.?

In which child are variations of food likely to "upset" the gastro-intestinal tract, and to produce urticaria and other toxic skin symptoms? In which are tuberculosis, typhoid, pneumonia, etc., or the exanthemata likely to gain access? Which child is laying a *foundation* for future visceroptosis, by absorbing toxins in excess of the natural resisting power of the liver and other organs which destroy deleterious chemicals (note that infection and toxæmia precede the visceroptosis), and which child is likely to develop mucous and other forms of colitis?

In their adult life how many of all these differences do we ignore or are ignorant of? It seems to me that we often read the histories of our cases improperly; thus, when we read books we begin at the *beginning* and go through in sequence, the facts unfolding as we go along and leading up to future effects, or explaining them in so far as they may be explained; but with *life's book* (the patient's his-

tory) we are most ignorant of the early important chapters, or we ignore them, and plunge boldly into chapter 20 or so, and yet we expect to understand fully the chapter we begin with and the rest of the book!

THEN WE ARRIVE AT THE TEETHING AGE

Let me add my warning to that of Mr. Colyer anent the danger of mouth-breathing. I had been told of this years ago by him and others of his colleagues, and I have carefully observed that adenoids, tonsils, and nasal defects, combined with evil habits of respiring, are invariably present in *children* who have gingival disease, and that gingival inflammation is very common in *young children* in both upper and lower jaws. Hence in coming to the age when teeth exist we also arrive at the adenoid and tonsil and mouth-breathing age. Here is a vicious circle; adenoids, etc., compel mouth-breathing, which increases the infection in the mouth; the mouth subjects the tonsils to greater and greater insults from the more numerous and more virulent bacteria present in the oral cavity, and thus increases the mouth-breathing, and so on.

The tonsils—pharyngeal and nasopharyngeal—of mouth-breathers must necessarily become more infected with bacteria than those of children who breathe naturally, and this of itself probably is the determining factor in producing what is called clinically “adenoids and tonsils.” Since all children *possess* these structures, it is only when the process of infection has proceeded long enough or with sufficient virulence to result in catarrh and inflammation of these otherwise beneficent traps that they produce symptoms—aside from a few exceptions.

Surely from such small beginnings the great lymphatic chain in the neck is infected (and this soon prepares the way by spade work for other master germs, such as the tubercle bacillus). A second manufactory, such as now exists, will also evolve a constant stream of toxæmic chemicals which will break down resistance elsewhere, and as the lymph-glands pass over the bacteria to succeeding ones and these in turn finally directly infect venules (or the blood stream *via* the innominate veins) a potential septicæmia arises which may result in a bacterial process in a joint, the meninges or pleuræ, or any other tissue *quite independently of the existence of ileal bands or stasis, or*

other intestinal lesion. It is absurd for Mr. Lane to narrow down causes of tuberculosis and rheumatoid, etc., joints to ileal stasis. Bronchial and genito-urinary sepsis are very potent antecedents.

Whatever the nature of the bacteria harbored by the healthy child's gastro-intestinal tract, they should, in a hygienically breast-fed infant, not be numerous or virulent, but the same cannot be said of those unhygienically fed, and particularly of those badly brought up on breast and artificial measures combined, or the latter alone. Cow's milk teems with bacteria, and it is unreasonable to believe that the bacteria associated with the mother's breast and milk are identical in numbers and virulence, even if they belong to the same species, as the bacteria associated with the cow's udder and milk; we know that the tubercle bacillus conveyed in cow's milk appears to be the cause of the greater number of tuberculous lesions in childhood. Who can rightly estimate the effects of differences in virulence of the same bacteria? We already know it means that one may be innocuous, the other pathogenic.

But when teeth appear and for any reason these become carious, or gingivitis is set up, then such children enter upon a most serious phase of infection.

Not only do the so-called normal bacteria increase immeasurably in number, but they increase in virulence, and, of even greater importance, they are added to by bacteria of different families; the septic mouth being a perfect paradise for bacteria of all varieties.

No organ can cope with unlimited constant streams of bacteria, so that the tonsils, stomach, etc., become inflamed and abnormal, and consequently the intestine is similarly infected. Herter, amongst others, has shown the immensely far-reaching influence of abnormal varieties of bacteria in the intestine, even infantilism of marked degree resulting.

BUT, ASSUMING THAT DAMAGE TO THE MUCOSA IS INDUCED BY THE ABNORMAL NUMBER AND VARIETIES OF BACTERIA IN THE GASTRO-INTESTINAL TRACT, WHAT DOES IT MEAN?

We know Nature has provided that so long as the mucosæ of organs are healthy, by which is meant free from inflammation and gross trauma, no absorption of any deleterious products takes place from the normal contents of those organs, in the bladder from the

urine and in the intestine from the food; but, in the presence of trauma and of inflammation, absorption of the chemicals of the urine and fæces does take place, even when the urine or fæces is healthy.

In reference, therefore, to Dr. Hale White's dubious opening remarks, we may consider two types of subjects: the *first*, the hygienically reared person, free from oral, nasal, etc., suppuration, with a normal uninjured mucosa, *is safe from toxæmic poisoning*, certainly from the food toxins; the *second*, possessing a superabundance of bacteria in its gastro-intestinal tract and perhaps of abnormal virulence and nature, *is liable to toxæmic absorption* both from food toxins and in particular—as I believe—from the end products of bacterial activity¹ (the latter, for all practical purposes, represents *the excreta of bacteria*), as well as those poisons present in the dead bodies of germs.

Hence my postulate that gastro-intestinal toxæmia does not exist apart from gastro-intestinal infection or, put briefly, gastro-intestinal sepsis.

In addition, with some modification with regard to small infants in whom slight errors or changes in diet appear to exert considerable effect on the gastro-intestinal tract, although in them also this invariably *results in inflammation*, and how much the effects are to be attributed even in these to bacterial agencies influenced by the said changes or errors in diet, is difficult to estimate. With some few exceptions I consider all lesions of the gastro-intestinal tract to be secondary to gastro-intestinal infection, and not to precede it. In particular would I instance constipation² and stasis, ulcers, peritoneal bands, and visceroptosis, which bear upon this discussion.

CAUSES OF GASTRO-INTESTINAL TOXÆMIA

In infancy I have attributed *infection* of this tract which leads to toxæmia to suckling, to the germs found even in the purest milk, in thumbs, nipples, and other dirty objects sucked, and to want of oral hygiene; some infection is also introduced in foods and possibly in other ways.

In later life to *carious teeth*, to *gingivitis* and other suppurative

¹ Murphy and Vincent, *Boston Med. and Surg. Journal*, Nov. 2, 1911.

² Peter Daniel, Medical Soc. Transactions, *Clinical Journal*, Feb. 19, 1913.

oral lesions, including *improper* dental mechanical stoppings and fittings of all kinds, but in particular to gold crowns and *permanent fittings*; i.e., which cannot be taken out to be cleansed. To these I unhesitatingly attribute the greatest amount of the almost universally distributed gastro-intestinal sepsis, and I do so *irrespective of station in life*, as I see it in doctors and dentists and their families, in clergymen, barristers, and patients in all social positions.

The tonsils, nasopharynx, nose and its accessory sinuses, the middle ear, also the bronchial tubes (for what is bronchitis, ultimately, but sepsis in these tubes, as unresolved pneumonias are mixed infections of the lung?); these are all common sources of gastro-intestinal sepsis.

The site of origin has a definite bearing on prognosis; if it is dental, so thoroughly *can* the local disease be cured that as a nidus of future infection it can be eliminated; but some of the chronic nasal suppurations, bronchiectasis and such like, are so intractable that all we can do is to ameliorate the quantity of infection arising therefrom.

The gall-bladder and ducts, once infected from whatever source, as well as some forms of appendicitis, are sources from which re-infection may constantly occur. My view is that these structures are *usually* primarily³ infected from the duodenum and cæcum respectively. Thus a vicious circle is established. Each nidus of infection is itself a source of toxæmia. The nidus might be insignificant were it to stand alone, although this is questionable, as its real significance lies in its potential power; like a spark or a match-flame, it may originate an overwhelming conflagration. In severe cases, on the contrary, the local infection may be most profound.

Another cause of increased infection and of toxæmia is the contiguity to the gastro-intestinal tract of inflammations—tubal, ovarian (other than those secondary to bands), lymphatic glands, and ulcers in adjacent coils or portions of the tract itself. Bands and kinks secondary to inflammatory processes lead to intestinal obstruction—intermittent and chronic as well as acute. Although in what I call noninfected persons (page 160) such bands are very rare, as they are generally secondary to lymphatic adhesions arising from infection by the intestinal mucosa—a roundabout vicious circle.

Parasites may result in trauma or inflammation, hence to toxæmia.

³ "Primary Mucous Colitis," *Proctologist*, Mar., 1912.

The Liver.—A great deal of importance is rightly attached to the liver and its functions, but the more the diseases of this gland are studied the more do we find its health depends upon the health or ill-health of the gastro-intestinal tract,⁴ of which it is but a part.

As Howell⁵ says, deleterious products find their way to the liver by one of two channels: (1) from the systemic circulation by the hepatic artery; (2) from the gastro-intestinal tract by the portal vein. Hence the liver is relatively protected from *systemic* infections by the small size of the hepatic artery, and although the splenic artery conveys infective material to the spleen, while the return flow from the spleen empties into the portal vein, such infective material as was conveyed by the splenic artery has been dealt with by the spleen, and (who knows?) perhaps only antibodies there generated may be carried to the liver.

But considering the size of the portal vein and its enormous capacity, draining the immense gastro-intestinal tract and the relative sources of poisons and damage becomes obvious. In short, gastro-intestinal toxæmia does not occur apart from gastro-intestinal sepsis. When the bacteria present in any part of the tract are numerous, or virulent, or what I am constrained to call abnormal, *they damage the mucosa*; through such injured mucosæ bacterial toxins, the actual bacteria themselves, and such food toxins as are injurious pass into the lymph stream and indirectly or directly into the blood stream; this constitutes gastro-intestinal toxæmia. That the main quantity enters the portal vein directly is probable; some passes away by the lymphatics to the dorsal sac, while much escapes into the peritoneal cavity and is there dealt with, and *does damage in the fight*. Food, stasis and other factors increase or otherwise modify the absorption, but unless associated with infection,⁶ *i.e.*, damage to the mucosa, Nature beneficently has arranged that toxæmia does not occur.

Statements are made that stasis leads to increase in numbers of the bacteria present; this is not so; on the contrary, after a very short interval they decrease in numbers and virulence, while repeated

⁴Peter Daniel, "Diseases of the Orifices of the Body," *Brit. Med. Jour.*, Jan. 15, 1910.

⁵John Howell, "The Chief Uses of the Peritoneum," *Brit. Med. Jour.*, Sept. 21, 1912.

⁶Murphy and Vincent, *l. c.*

attacks of mild diarrhœa lead to the converse, *i.e.*, increased numbers and virulence of living bacteria in fæces; but these statements are made concerning the bacteria *excreted in fæces*. What we want to know is, *what happens to the bacteria adherent to and in the intestinal walls* under the conditions mentioned? Because I believe that the toxæmia is due chiefly to germs which gain access to the mucosa or which adhere in the mucus to the mucosa, as, of course, the bulk of the particulate food does not come into contact with the mucosa in the large intestine, whatever may be the case in the small bowel.

Unreasonable results are expected from the examination (bacteriologic) of *exudates and effusions* which are the *result* of bacterial infection of the walls of cavities in which such exudates lie. Negative findings seem to me quite reasonable; what we need for examination are *portions of the infected tissues*.

We need but to remember that in such a definite lesion as amœbic liver abscess the fluid pus contains few amœbæ, and a scraping from the abscess wall is necessary to enable one to demonstrate with certainty the presence of the amœbæ. So, in the important matter now under discussion, I think the examination of scrapings or swabs from the intestinal walls is absolutely necessary to give the bacteriologist definite and correct data on which to base sound conclusions.

Mr. Lane quotes the findings of *Staphylococcus citreus* in the blood of a patient, and its recovery from a swab smeared over the intestinal mucosa; this is a sound piece of work. It should be remembered that the *Staphylococcus citreus* forms about 4 per cent. of the mouth flora. (Miller, quoted by Hunter.)

My knowledge of intestinal toxæmia is based upon experience, chiefly clinical, but to a certain and most valuable extent pathological, —*i.e.*, morbid anatomy in the postmortem room. In addition I have had the great advantage of knowing intimately the painstaking, thorough, and conscientious original investigations of my colleague, Dr. William Hunter, who has directed his attention to this subject as has no other observer extant, and whose microscopical slides, bacteriological findings, and morbid anatomy specimens are a monument of exact work which, impartially considered and studied, would of themselves convince anyone of the existence of what he designated briefly "septic" conditions of the gastro-intestinal tract likely to lead to what is called intestinal toxæmia.

We find in postmortem specimens lesions of the whole gastro-intestinal mucosa, ranging from almost imperceptible catarrh to the most intense ulceration, in some cases so extensive that more than two-thirds of the mucosa of the large intestine has disappeared, and of such intensity that the whole thickness of the intestine—small and large—has been eroded, and perforative peritonitis has resulted.

These lesions have existed in cases in which the presence of typhoid, tuberculosis, syphilis, Shiga's and amœbic dysentery, pneumonia, diphtheria, and other specific organisms which are known to produce occasionally such intestinal lesions, *was most particularly excluded by investigation*; and in all cases the lesion has always been associated with some suppurative condition in the commencement of the gastro-intestinal tract.

When these intestinal conditions are examined properly,—*i.e.*, without removing the mucosal débris,—it is found that the evidences of inflammation present are invariably associated in these cases with the presence of cocci—streptococci and staphylococci—and that these appear to be identical with the cocci isolated from the suppurating focus which discharged into the gastro-intestinal tract at its commencement; namely, the mouth or nose, etc.

When, in addition to catarrh, atrophy, and disappearance of villi, of Lieberkuhn's glands, etc., we find definite necrosis of the epithelium, especially on the tips of the valvulæ conniventes and other folds of the mucosa,—also gross ulceration,—is it reasonable to doubt that absorption of the poisons generated by bacteria occurs in such places, and that escape of the actual bacteria into the lymph-spaces in the walls of the intestine and into the peritoneal cavity is inevitable, and produces locally cellulitis and other inflammatory manifestations; also that such escaped bacteria obtain admission ultimately into the blood stream, so that a condition of potential septicæmia arises! Can one doubt this, even though we know not the nature of the chemical toxins?

As regards the bacteria, it is unquestionably that all Koch's postulates are demonstrable; Lane's *Staphylococcus citreus* could have been used to complete the proof (page 167).

But there is every grade of gastro-intestinal infection, and it is the milder grades which are so frequently overlooked and produce symptoms of such diverse kinds—though all are inflammatory—that

they cannot be so easily classified or traced and which are really the reason of this discussion. Yet if we recognize the origin of these symptoms as due to absorption from some septic condition of the gastro-intestinal mucosa and the removal of this condition is certainly and invariably followed by marked amelioration and, generally, cure of the symptoms under suspicion, we must trace the condition as one of cause and effect.

Differences in degree exist in all diseases, yet the fundamental processes in all degrees are the same. So with gastro-intestinal toxæmia: if the graver inflammations of the mucosa are due to bacterial processes and result in toxic absorption, so, only in lesser degree, are the milder forms of catarrh due to the activity of bacteria and result in toxic absorption.

As with every other disease, there are accessory factors in gastro-intestinal diseases, but some of us consider that the accessory factors are the real ones, but what these call the real factors are simply *accessory ones*. I hope this full discussion will clear up much that is obscure in this respect.

Typhoid fever and other known intestinal lesions, I believe, apart from dose and reinfection, attack those who have septic intestines, and in typhoid the perforations and hemorrhages from sloughing are much more likely to arise in septic intestines than in those of persons whose intestines are affected by only the mild, inevitable bacteria, as explained on page 160.

We now know how persistently bacteria cling to tissues they have infected, but to none more so than to mucosæ, so that it may take an appreciable time to cleanse a mucous tract from the bacteria which have soiled it after the original source of infection—even by one dose—has been cured or removed; yet so great and important in maintaining the symptoms of toxæmia is the part played by constant, steady reinfection from a local focus that as soon as this local focus has been cured or removed immediate improvement in the symptoms takes place, and usually out of proportion to the degree of absorption likely to have taken place directly therefrom. The converse holds true, also, that the slightest recurrence of suppuration in the primary focus results in a disproportionate increase of the gastro-intestinal toxæmia and its symptoms.

A large number of the specimens in museums labelled “Mesenteric

Emboli," but in which the embolus is not demonstrable, are really cases of thrombosis, and have originated in septic states of the intestinal mucosa,—*i.e.*, are cases of acute enteritis going on to thrombosis. That thrombosis following mucosal sepsis is the immediate cause of many perforations, such as acute duodenal and gastric ulcers, is highly probable, as all the conditions necessary are invariably present; all the other theories seem to me far-fetched. Bolton's work needs considering in this light,—*i.e.*, as a cause of minute thrombosis.

I have examined the sigmoid with the sigmoidoscope and seen epithelial necrosis, small hemorrhages and ulcers, and on opening the abdomen found the whole sigmoid (*i.e.*, the whole wall) a turgid red tube, stiff and rigid, resembling, in color and consistence, a piece of rubber tubing an inch in diameter, *a massive colitis*, and in 16 days seen it converted into a gray, rotten, flaccid tube like wet brown paper (yet the peritoneal cavity did not contain pus, and the patient died of asthenia), the whole lesion being an acute exacerbation of a mild intestinal infection of oral—gingival—origin.

SYMPTOMATOLOGY OF GASTRO-INTESTINAL TOXÆMIA

The *effects* of gastro-intestinal infection are the *symptoms* of gastro-intestinal toxæmia, and, as these are diffused all over the body, to efficiently enumerate them necessitates a consideration of the diseases of all the organs of the body. In various papers I have indicated some of them in outline. Because it must be remembered that the more enlightened we become, the more do we find that almost all diseases—certainly bacterial diseases—are septicæmic in their nature.

Who now considers typhoid fever as a disease limited to Peyer's patches, or pneumonia as purely a lung lesion? Almost all diseases enter the body by one of its orifices, and certain tissues or parts appear to be more vulnerable to certain bacteria than others, so that a pronounced *local* manifestation of that disease arises; but its ravages extend all over the body; it is, in fact, a septicæmia—a blood infection—and wherever this fluid, infected with the causal bacteria, flows *there* may manifestations of that particular disease appear.

Is scarlet fever a local gastro-intestinal disease because its chief manifestation is a throat lesion? If not, then it must be a septicæmia! And *if it is a septicæmia*, who can deny that a septic infection of the

tonsils known as quinsy may not be a potential septicæmia, since the essence of the latter is that bacteria from some local nidus or injury pass into the blood stream and survive there in a viable state, and we know from experience that such throat-lesions often are true virulent septicæmiæ leading to death.

In brief, whatever the nature of the toxins which gain admission to the blood stream, they eventually damage the secondary protective organs of the body, and finally circulate about all the living tissues. Not only toxins, but living bacteria constantly escape from the gastro-intestinal tract, and set up a condition of potential septicæmia. Is it surprising that secondary manifestations of this gastro-intestinal septicæmia arise in bones, joints,⁷ organs, skin, and serous membranes; and, least of all, that the liver and kidneys should be gravely damaged?

I know of many deaths due to septicæmia of oral origin.

That *cardiovascular disease* and blood degeneration ought to be frequent, as they are, in my opinion, or that directly or indirectly *neuritis* is very common, also that many other symptoms and diseases of an obscure nature are due to gastro-intestinal toxæmia. In my clinical experience I cannot recall any one organ or tissue which has not been gravely diseased in one patient or another from gastro-intestinal toxæmia. But to state that gastro-intestinal stasis (or toxæmia) is a more direct cause of genito-urinary disease than extension of disease *via* the urethra is going too far, except in so far as "spade work" goes.

Typhoid toxin appears to produce marked degeneration of cardiac muscle, and if we knew what structures are most vulnerable to each coccus or bacillus resident in the infected gastro-intestinal tract we might apportion to each one its moiety of blame in the very complicated symptomatology arising therefrom. And as Zenker's degeneration was discovered through the great amount of effort and time spent in minute research on the disease typhoid on account of its importance, so definite degenerations would be found to be present in various tissues, including the heart, were as much time and material available in—shall we say?—oral sepsis,—and Hunter has shown how widespread is the damage which can be demonstrated.

The literature teems with specific instances of disease set up by

⁷Peter Daniel, "Arthritis: A Study of the Inflammatory Diseases of Joints," Bale, Son, and Daniellsson.

gastro-intestinal toxæmia, but I do not think one tithe of the *everyday symptoms* due to it is recognized, and the simple fact remains that in the search for causes for symptoms the most abstruse are preferred to the plebeian "bad teeth" or "running noses." When revising and re-editing Green's Pathology, in 1904-5, Dr. Bosanquet invited my criticism, and I then suggested that if a streptococcic infection of the tonsil called scarlet fever could, in a few days, evolve such intense and virulent toxins as to cause grave degeneration of the kidney epithelium, why was it not possible for chronic septic tonsillitis in the *course of years* to produce such an amount of toxin as to damage the kidney substance and produce chronic nephritis? In such a book as Green's, Dr. Bosanquet considered it inexpedient to publish anything that was not fully recognized and standard teaching, so it was dropped.

Recently *three* cases of acute nephritis have been recorded⁸ in which the physicians, recognizing the lesion as secondary to septic tonsils, insisted upon excision of the primary foci with instantaneous and permanent improvement. I have known two cases semi-comatose with uræmia begin to improve within a few hours after the extraction of six and eight foul septic teeth surrounded by suppurative gingivitis.

Ascites cases are septic without exception, and in such few cases as I have had to deal with I have throughout always observed benefit from the extraction of carious teeth, etc.,—i.e., local foci of supuration,—and in one case the drainage of an antrum. In those cases not too far advanced such treatment has always been the turning-point in their condition and led to improvement,—that is, if they did recover.

Surely, treatment by purgatives cannot be effective solely because of the removal of some ten to twenty ounces of liquid from the bowel in a case with many gallons of ascitic fluid, but it is principally due to the removal of large quantities of toxins and toxic-forming materials from the bowel, so preventing their absorption into the blood, and thus sparing the tissues, liver included, which are thereby enabled to recuperate. Nightly laxatives are, in my opinion, the best and only intestinal *disinfectants*.

*Joints*⁹ I consider one of the favorite hunting-grounds for gastro-

⁸ *Brit. Med. Jour.*, epitome, vol. j, 1913.

⁹ Peter Daniel, "Arthritis: A Study of the Inflammatory Diseases of Joints," Bale, Son, and Daniellsson.

intestinal toxins; but, as I believe the actual bacteria are present in all of these secondary lesions, I here speak of toxins comprehensively.

Cases of exophthalmic goitre and other forms of goitre repeatedly I have seen recover or amend in a very remarkable manner after the removal or correction of local septic foci, and treatment of the gastro-intestinal tract by laxatives and enemata.

McGarrison's work is confirmatory of the statements I made four years ago on this matter.¹⁰ One recent case of pseudo-exophthalmic goitre in a woman telephone operator, 25 years old, who previously had her tonsils and such adenoids as still persisted removed, had, with the exception of a carious molar, no other oral sepsis, had been under treatment in private and in hospitals, but came to my O. P. I sent her to the throat department for opinion and to be put in order if necessary; she was returned, and the opinion given that there was little or nothing to be done to the nose or pharynx. So I treated her on orthodox lines, but with little or no improvement. I then ordered her nasal douches,—as it was obvious she had a slight nasal obstruction from rhinitis (?),—and continued laxatives and the specific drugs. I did not see her for two weeks, but as soon as one saw her on her next visit the improvement was obvious, and she expressed the utmost relief: her neck was an inch smaller. She soon ceased drugs, and discontinued to attend, as she felt well (douching continued). Could any treatment be more simple? No operation, no vaccine, no drugs.

The signs and symptoms Lane attributes to stasis are, of course, due to the septicæmic nature of the infection in the mucosæ. What he will not grant is, that such may occur without stasis *from infection alone*; yet I think enough evidence exists to show that such is the case.

It had always struck me that scurvy, Barlow's disease, and septicæmia in childhood had many points in common,—that is, that they were septic processes.

Dr. W. Morton Hewetson, M.B., Ch.B., D.P.H., Medical Officer to the Wankie Colliery Company, South Rhodesia, has written a paper¹¹ recording his observations and experiments on *scurvy* in native workers ("boys"), which seems to me conclusively to prove that scurvy in them is directly due to oral sepsis. Wankie is an endemic centre for scurvy; its situation, the physical configuration of

¹⁰ "Diseases of the Orifices of the Body," *Brit. Med. Jour.*, Jan. 15, 1910.

¹¹ *Transvaal Medical Journal*, April and May, 1911.

the surrounding country, and its climate produce a mean temperature of 77°. Scurvy is its *bête noir*, and deaths from other causes are negligible. The deaths from scurvy in 1909, when Dr. Hewetson took charge, were as follows (pneumonia is often recorded as the cause of death):

Recorded as scurvy death.....	27
Recorded as pneumonia deaths	13
	<hr/> 40

Incidence of scurvy among 400 "boys" at work: Of these, 134 showed scurvy gums (earliest sign, Osler), 50 went sick voluntarily with symptoms of scurvy beyond the gum stage (hence, many more may be assumed to be affected). Thus, fully 50 per cent. of all the employees were affected at one time.

"In spite of the diet scale being increased above the requirements of the Government (designed to prevent this disease), the position was grave, owing to the number of deaths, the awful condition many were in, and the number who were sick, amounting sometimes to 30 per cent."

The Government Medical Inspectors (men quite unbiassed by pecuniary motives or interest in this paper of Hewetson, perhaps antagonistic to his final views) reported: "I find that you have on your property over 120 'boys' suffering from scurvy. Almost all these cases are in such condition as to necessitate treatment in a properly-equipped hospital."

They were consequently despatched to Bulawayo and Livingston Hospitals. The report serves to show us how serious was the nature of the scurvy.

Hewetson took charge at this time; he had no "views" on scurvy, was a modern student, had imbibed the laboratory spirit, and was versed in the general theories anent scurvy being a *blood* disease from acid or alkaline, etc., changes and intoxications, quoting Sir Almoth Wright, also Dodgson and Stewart, South African authorities, and others. He had no predilections toward heresies, such as oral sepsis, etc., although he was conversant with the literature. After much thought and experience he began to see daylight, and says:

"Searching for a guide to early recognition of the disease," and concludes: "Hence it was legitimate to conclude that the *gums* showed the first signs of scurvy, and that the disease might progress no further, and that if I could only keep *their* condition satisfactory I would have little to fear from the gross effects of the disease. I took this as my guiding principle, and at the end of a year, having dealt with a large amount of this gum condition, I can say it has proved absolutely satisfactory."

Thus Hewetson recognized the gums as a guide; *later* he recognized *that disease of the gums was the cause* of the scurvy, but not yet, for he says: "I felt indeed that the actual cause of this condition was still an unknown secret to me."

A grave recurrence of cases took place, hence "he considered the moment opportune for *thorough tests of the relative values* of the so-called antiscorbutic articles to be made." His cases were men from 20 to 25 years of age, in good condition, having abundance of food, and housed in huts. A few youths "acting as valets" were investigated (*these were not employed in the mines*). Then he began to study the mouths of those who developed scurvy in relation to their tribal customs, which consisted in *mutilating their teeth*.

Four tribes at least were employed:

(1) *Zambesia*.—These knock out the six upper front (permanent) teeth.

(2) *M'lozi*.—These file away the contiguous margins of the two upper central incisors, forming an inverted V.

(3) *Awembas*.—These file their four upper incisors to a point.

(4) *Nyassaland Boys*.—Do not mutilate their teeth in any way; they exercise more care in cleansing them, and are generally of much higher intelligence. *I find they are rarely affected here*, and not till the later part (bad period) of the season.

Zambesias.—Knock out six teeth, and constitute the *bulk* of the patients, being $2\frac{1}{2}$ to 1 of all the others; *i.e.*, *Zambesias*, 13.4 per cent.; remainder 5.4 per cent. They are a longer time in getting well, and in every way require more care (in treatment).

Awembas.—Mutilate four teeth and are equally affected with scurvy as the *Zambesias*.

The youths not employed in the mine are not investigated fully,

but such as are bear out the conditions of the adults. This applies to the women also, who do not usually mutilate their teeth, but take great care of them. Two out of 27 were affected; one was mutilated with six teeth out.

Deduction.—It is patent that those with mutilated teeth “are much more liable than those not mutilated; that here we have one common factor, a partial key, at least, to the situation. Only *one* of the experimental cases (see later) had un mutilated teeth, and his upper central incisors were markedly everted, thus losing their power of opposition to their lower counterparts.”

The gum of that portion of the alveolar process from which the teeth are avulsed and the cavities closed up is, I was going to say, *never* affected, but I have seen it once.”

Then he notes the influence of tartar, and describes the changes occurring from loss of apposition of the teeth:

“Tartar is present as a thin ring at the dentogingival junction in *all* the natives here; very bad in some.” The many facts concerning the teeth of the natives, their ways of bolting food, and other interesting observations he makes, I must omit, and come to his great experiment in treatment.

HEWETSON'S EXPERIMENTAL TREATMENT OF SCURVY

He takes so many scurvy patients, makes no selections, but tries to divide them into three equally bad groups, houses them in the same hospital, and devises a dietary for the three groups. He uses no drug treatment.

That is, the *first class* of patients have lime juice and soups made with special vegetables, and fresh meat, *in addition* to the customary diet of the natives.

The *second class* have one pound daily of raw meat, later one pound of potatoes, *in addition* to the ordinary diet.

The *third class* are kept on their ordinary diet, with no anti-scorbutic juice, raw or fresh meats, or soups. *The only difference in treatment is that those cases treated by diet, etc. (1 and 2) are not permitted to cleanse their teeth, while those kept on their usual diet are treated solely by tooth-brushing and mouth hygiene.* No drug treatment was given to either class.

The result is summarized thus (briefly quoted):

"The most important and outstanding fact appeared to be that not only was no cure recorded in Groups 1 and 2, but, in spite of complete rest, hygienic conditions far superior to those obtaining in their huts, and on a diet which to the native is riotous, two cases, very slight at first, became so much worse that a change of treatment (from the strict scientific method!) was urgently indicated. Lime juice failed signally to show the slightest trace of benefit."

Turning, however, to Group 3 (ordinary diet, the only treatment mouth hygiene): "I found a solid basis of successful result, attained

DIET GROUP 1	DIET GROUP 2	DIET GROUP 3
<p>a. <i>Lime juice</i>, crude, 2 drs. with water, <i>bis die</i>.</p> <p>b. <i>Soup</i> at end of week, 1½ pints. Soup made of <i>mixed fresh vegetables</i>. <i>Meat</i>, ¾ pound, included in the soup.</p> <p>c. Mealie meal porridge, <i>ad lib.</i>, monkey nuts, 2 to 2¼ pounds per week, and last, <i>ad lib.</i></p> <p><i>Tooth-Brushing not allowed.</i></p>	<p>a. nil.</p> <p>b. One pound good fresh meat daily, issued raw.</p> <p>c. Potatoes, 1 pound daily (after a fortnight); mealie meal porridge.</p> <p><i>No Tooth-Brushing.</i></p>	<p>a. nil.</p> <p>b. nil.</p> <p>c. Mealie meal porridge, <i>ad lib.</i>, monkey nuts and salt as (c) in Group 1.</p> <p><i>Tooth-Brushing</i>, 6 to 8 or more times daily, persistent and hard, and rinsings with izaral mouth-wash.</p>

steadily and perceptibly, and which could not be attributed to improved hygiene, good feeding, or other cause, except the *direct effect of the persistent, vigorous use of the tooth-brush and antiseptic mouth-wash*, in (1) cleansing bacteria and food particles from the teeth and gums, and (2) stimulation of the gums by friction—one might call it massage.

"These cases were discharged and sent to work with gums in a satisfactory, firm condition after an average of 11 days each.

"These experiments concluded the proof that the condition known as 'scorbutic gums' is *purely and simply a local inflammation*."

I would commend this paper strongly to Mr. Lane, as here there is no mention of stasis; the cases are strong, vigorous young men;

the other factors in inducing the attacks of scurvy are the peculiar climatic conditions of the district, and are coincident with the increase of other diseases, such as tuberculosis and pneumonia amongst other non-scorbutic lesions. A chart illustrates this clearly. He cures the cases without dealing with the stomach and intestine in any way; so, if stasis is present, neglect to cure it does not prevent the cure of the acute oral sepsis. Also, can it possibly be argued that the sepsis in the mouth arises by the development of intestinal stasis within a few months (weeks in some cases), yet no treatment is directed to the suggested great cause, i.e., the stasis, but only to its effect—the oral sepsis—and cure result?

He goes into the bacteriology of gingivitis, etc., but the whole paper is so valuable that it should be read in its entirety.

I noticed in reading Amundsen's book on his trip to the South Pole that he instituted a tooth-cleaning drill, and that there is no mention or indication of scurvy throughout the trip. In the late Captain Scott's book he mentions the discomfort of being unable to clean the teeth, but with no appreciation of its great hygienic value; it is merely an "aside" in his record. His party suffered from several outbreaks of scurvy, mild on the whole, but apparently more severe in some cases, which included one of the most energetic and vigorous of his officers, namely, Shackleton, who is invalided home solely on this account. Here is one party in which mention is specifically made of the fact that they devote regular attention to their teeth, and regard it as of importance. Their records give no evidence of scurvy in any stage; on the contrary, the health of the party is shown to have been magnificent throughout; Amundsen comments upon it: I believe the Scandinavians do take greater care of their mouths than our people generally do.

On page 93 of the discussion, Royal Society of Medicine, London, 1913, Mr. Lane attributes the frequency of cancer of the rectum to the "impact of the firm end of a motion"; he says nothing of bacteria. Again, later, he says that "ulcers in colitis develop at the site of bands and membranes": this is certainly not the case, as they are found often as isolated ulcers in the middle of the transverse colon, while the arch of the sigmoid is a favorite site.

Ulcers often exist without giving evidence of their existence; for example: A woman was admitted into a gynaecological ward for the

purpose of curetting; she was given an enema and immediately became collapsed; as a consequence operation was postponed and the patient watched, but she grew rapidly worse and died. At the post-mortem, ulceration of the upper part of the rectum was found, and a perforation into the general peritoneal cavity which was the result of the distention by the enema. Other ulcers existed.

Within one year after the former case, another young woman was admitted for vascular caruncle; she also became collapsed when an enema was given. The temperature rose, and her condition became unsatisfactory. On the seventh or eighth day a slough about 12 inches long came away; it consisted of the whole thickness of the mucosa. A week later I saw her, and advised laparotomy and the performance of a colotomy in the transverse colon. This was done, and a definite ulcer was discovered in the middle of the transverse colon, while the descending colon as far down as the lower end of the sigmoid was a grayish membranous track.

I did a colotomy in the right half of the transverse colon; but as the patient was not very fit physically, and I hoped that the peritoneum over the descending colon would prevent gross peritonitis, I therefore did not excise this part. After an initial spurt she gradually sank, and I could find no clear indications why she had such persistent asthenia. At the postmortem septic peritonitis, as usually understood, was not found, but so great had been the escape of bacteria from the denuded descending colon that a considerable membranous peritonitis existed. The immediate cause of death, however, was a small purulent collection localized in the parietes on the right side of the colotomy, and slightly extending into the peritoneal cavity.

I operated for piles upon a young man in good circumstances. He suffered from slight albuminuria, but, except for bleeding and prolapse of the piles, he felt well; *i.e.*, he complained of no abdominal pains, diarrhoea, or mucous discharge. He had considerable oral sepsis, and would not have this corrected. Some four years later he saw me again. He had no trouble in any way with his bowel, which was regular in action, he felt well except for sexual neurasthenia, which was a source of worry. But he said that for two years he had had discharge of mucus and traces of blood. I examined him with the sigmoidoscope, and found well-marked necrosis of the epithelium of the sigmoid and a few definite ulcers, the most marked

area of mucosa affected being the junction of the rectum and sigmoid. In spite of my objurations he refused to submit to radical treatment, and his bowel got steadily worse until the rectosigmoid junction became greatly swollen and the superficial necrosis annular. With this constipation set in, due to swelling and partial intussusception, and it was absolutely necessary to administer laxatives and give enemata.

Finally appendicostomy was done. As I told him, I could not short-circuit, which was the ideal operation, because I could not get below the disease in the rectum. He first improved, then steadily got worse, and at last the bowel perforated into the bladder, and he submitted to a colotomy. He died in 10 days from toxæmic asthenia. His colon was so friable that I tore it wherever I touched it, and I could not have excised it cleanly. When I saw this man he must have had colitis markedly for *two years*, yet he did not think there was anything wrong with his abdomen. Like other similar cases that submit to radical dental treatment, I believe this man would have got well had he submitted to removal of the focus which was constantly re-infecting his bowels; namely, his teeth, which kept up the severe gingivitis which existed.

This patient was most careful in his habits, was not constipated, had never been abroad, had no kinks, bands, or other intraperitoneal causes of delay or stasis; he was spare in figure but well developed, performed exacting duties for long hours when necessary without undue fatigue, and took regular exercise and good food. His complexion was a most marked feature; any woman would have been content, and most women happy, to possess it.

There is one ingredient which I always find in the urine in excess when the gastro-intestinal tract is infected and catarrhal,—that is, phosphate,—what variety I do not know; it comes down on heating, and exists when the urine is neutral or slightly acid. Excess of indican in the urine, recognizable in the same easy clinical manner, I do not observe, nor, from what I learn, do I believe that it is a real sign of gastro-intestinal catarrh.

STASIS IN THE GASTRO-INTESTINAL TRACT

Having given the opinion that infection of the mucosa is the real and primary cause of the toxæmia, I would like to say something

about stasis. Mr. Arbuthnot Lane attributes intestinal toxæmia to:

(1) Stasis of the food (see former and more precise papers) produced by the development of bands and membranes which bind down especially the last few inches of the ileum, and which prevent this portion accompanying the remainder of the ileum and the cæcum in their descent into the pelvis, and so lead to a kink. This kink prevents the food passing into the cæcum. The appendix may be similarly fixed by membranes and may then obstruct the effluent, and so on.

(2) No. 1 kink is succeeded by a second kink at the duodeno-jejunal flexure, chiefly induced by the weight and traction of the loaded ileum.

(3) As a result of No. 2 kink the first stage of the duodenum dilates, and ulceration may follow; obstruction to the stomach contents also occurs, and the dilation, etc., extend into that organ.

Mr. Lane emphatically states the bands are due solely to the assumption by man of the erect posture, and calls them "evolutionary," which he interprets *not* as being common to the whole race and tending to be fixed and permanent, but as a personal acquired characteristic; in fact, so easily acquired as to be well marked in infancy—within two years of birth. He as emphatically repudiates that inflammation plays any part in the formation of these bands and membranes.

In support of this belief he enunciates certain views and uses a pretty mechanical phrase; he also refers to bone changes following fractures and dislocations, laborious occupations, etc.; I will not enter upon that except to say that since gastro-intestinal toxæmia is so widespread and so potent, upon Mr. Lane's own showing, as to lead to cystic changes in various organs, to profound inflammatory changes in *all* the tissues of the body, in which statement I entirely acquiesce, I would ask, why may not the changes he describes in the bones and periosteum after fractures, etc., *also be due to the universal toxæmia acting upon damaged structures and keeping up a chronic inflammation therein, most marked and persistent in the parts kept hyperæmic by "lines of stress"?*

I think it quite reasonable, as I am convinced that osteitis deformans,—an imperfect ossification in fibrous tissues,—is due to systemic toxæmia derived chiefly from the gastro-intestinal tract,

partly from the genito-urinary tract, and possibly the bronchi, sometimes syphilitic. Poker spine and other bone and joint lesions closely allied to the bone and periosteal changes Mr. Lane refers to are certainly due to such toxæmia.

The occupation lesions portrayed in this paper are, therefore, understandable, since the greater the strain on any structure the more pronounced the influence of any systemic toxæmia upon such structure.

If strain is the only factor producing these bands and membranes, why is it that the gastrohepatic omentum does not hypertrophy or thicken or develop Lane's bands and membranes? Surely, gastroptosis is one of the most common lesions seen clinically and in the operating theatre; I have never seen such hypertrophy, nor does Mr. Lane describe it, nor has the literature ever recorded thickenings, but, on the contrary, thinning of this omentum: an ideal position for evolutionary bands.

In prolapse of the rectum, even the severest varieties, we do not observe these evolutionary bands, yet this portion of the bowel ought to be a frequent source of such bands, were they due solely to strain. Likewise prolapse of the uterus leads to atrophy or thinning and stretching of the peritoneal supports, not to hypertrophy or thickening, even if the argument were advanced that thinning is a final or end effect of the prolapse. Nevertheless, we should observe the thickenings in cases of moderate severity, or those not yet at the stage of failure to bear the continued weight. In the peritoneal cavity analogy is all against the evolutionary theory of these bands.

Let us ask ourselves which proposition—etiologically—is most reasonable: Mr. Lane's, which, *in a child of 2 years, as a result of* crystallization of lines of resistance so acting as to prevent the sigmoid slipping down into the pelvis, has already developed "evolutionary" bands of such a dense nature as to produce grave and extensive bowel stasis and tuberculosis of a joint?

How much strain, and for how long has it been applied in this wee life, spent in bed or otherwise reclining for a large proportion of its existence, for the reaction of the lines to be called into play?

On the contrary, we know that almost from the moment of its birth this child (hospital case) has had an infected bowel, that bacteria have been escaping constantly into its peritoneal cavity, that

stasis of lymph flow occurs at such positions as these bands develop in—between the viscera and the parietes, especially low down at the root or attachment or reflection of the peritoneum from the viscera on to the parietes—that one year is a long time for an inflammatory process to progress, and would be a reasonable period in which bands could develop.

About the appendix the bloodless folds are amongst the very first to become obliterated, because they act as such perfect pockets for bacteria-infected lymph. The retrosigmoid pouch is another normal pocket which readily obliterates. The thinner the mucosa the greater its vulnerability, hence tubercle bacilli as well as the normal (?) intestinal bacteria pass more readily from the lumen of the intestine in children.

In such a case—large bowel stasis and that in the sigmoid—surely enemata would completely empty the gut. Has Mr. Lane tried treating such cases by consistently washing out the colon, and observed the excellent effects upon tuberculous cases?

Throughout his whole thesis,—although from time to time he has shifted his ground when time or experience has brought him face to face with difficulties,—one thing Mr. Lane has consistently stated: that stasis leads to degeneration and fibrosis of all the tissues of the body,—and let me assume for the moment that *local* spread of toxins from the lumen into the intestinal wall and peritoneal cavity does not occur, so eliminating this cause of bands. Is not the peritoneum one of the tissues of the body, and is it not subject to the common assault from toxins circulating in the blood, or is it exempt from this also? Lucky peritoneum!

When we know that Jackson's membrane, Lane's bands, etc., are all found in the fœtus about the time the various transpositions of the intestine take place,—some time before the third month of intra-uterine life *when the intestinal tract is not in use*,—it seems to me conclusive that Mr. Lane's pathology is erroneous.

May these intra-uterine bands and membranes be due, on the contrary, to inflammation? I think so. Because we must assume that the mothers of these fœtuses are just average types of poor persons in whom systemic toxæmia is present,—gastro-intestinal, genito-urinary, bronchial, and so on,—it is inconceivable that maternal toxæmia has no influence upon the developing fœtus.

If so, what more likely than disturbance of the normal development of such an intricate piece of architecture as the peritoneal changes connected with the transposition of the viscera? At the least it is shown that the proportion of fœtuses with these membranes and bands is about 5 per cent., and it is possible that this proportion is larger than among those who give the characteristic symptoms of ileal delay in adult life. Mr. Lane now says the sigmoid bands "appear before the erect posture is assumed."

Herniæ.—Intestinal toxæmia should be a marked symptom of stasis induced by *mechanical* obstruction in cases of inguinal and femoral herniæ when these lie in narrow-necked sacs and are irreducible from adhesions; particularly should this be the case on the right side, in which the lower coils of the ileum are so often involved, and occasionally the cæcum and appendix.

Delay in the passage of the liquid contents through the coils of the ileum in the hernia, especially in femoral hernia, *must* occur if the bands and membranes found at the lower end of the ileum are capable of causing obstruction; but we do not find in hernia cases the Lane "symptom-complex sequence," nor have these lesions been associated with duodenal and gastric ulcers; yet the cases frequently are associated with visceroptosis.

These herniated portions of bowel develop peritoneal adhesions and definite bands, owing to repeated attacks of inflammation (no doubt oftenest induced by pathological changes in the mucosa) which are set up in the bowel of these cases as in most other patients—intestinal sepsis; but that these effects are accentuated in the herniated portion, and the effects of the escaped bacteria upon the peritoneum are more marked there on account of the associated factors, one of which, stagnation of the infected lymph in the hernial sac, is of the utmost importance.

Mr. Lane says the evolutionary bands and membranes develop chiefly over the *inferior* aspect of the "circumference" of the *ileum* and the mesenterics, and lays great stress upon this, in so far as he considers it one proof that they cannot be inflammatory; yet, when dealing with the sigmoid, he points out that it is the external aspect of the mesentery and the bowel which is here involved; and surely the bands and membranes which develop at the duodenal flexure are

superior, so it is obvious that from situation alone no deductions can be drawn.

Let us examine this more closely. In a most interesting paper written by Howell,¹² of Cheltenham, he suggests that the main everyday use of the peritoneum is to deal with the bacteria (and toxins?) which *normally and constantly* invade it from the intestinal lumen and the systemic circulation; its surface is loaded with leucocytes. And Wilkie,¹³ of Edinburgh, makes use of the reaction which an abdominal inflammatory lesion induces in the leucocytes, to form a prognosis, and to decide whether the peritoneum should be drained or not drained, washed out or not washed out.

It is generally recognized that the serous membranes and the endothelium of lymph-spaces, as well as the endothelium of blood-vessels and all fibrous tissues (*i.e.*, the progenitors of fibroblasts), are *the* great phagocytes in extravascular inflammatory processes, and that they are the great repairers of the damage done by such inflammations; and since nearly all repair is by fibrous tissue,—*i.e.*, scar tissue,—we would expect membranes to be the usual form of repair in the peritoneal cavity; later they are pulled and rolled out into bands.

As bacteria are constantly leaving the lumen of the gut to escape into the lymphatics in the parietes of the intestine, we know that if the peritoneum is stripped off they escape into the peritoneal cavity also very quickly and in enormous numbers. It is the prevention of this massive escape and invasion of the peritoneum in man who has become specialized, and the destruction of those which do gain access every moment thereto, that I have always regarded as the chief function of the peritoneum. (*Vide* Howell's paper.)

As it is to be assumed that the right side of the peritoneal fold is equal in function to the left side, one would imagine there would be produced upon the peritoneum in its life-long struggle with toxins and bacteria a uniform effect in the way of damage and repair; so there *would* be, *were everything equal*, and it is these other factors which make for seeming inequality of result in the form of membranes and bands localized to certain parts.

We know that depressions, pockets, folds, etc., often determine

¹² John Howell, "The Chief Use of the Peritoneum," *B. M. J.*, Sept. 21, 1912.

¹³ D. P. D. Wilkie, "The Prognostic Value of an Immediate Examination of Peritoneal Exudates," *INTERNATIONAL CLINICS*, vol. iv, 22nd series, p. 145.

collections of pus, such as into the renal fossæ. Now in the peritoneum are innumerable such small depressions, pockets, and folds, often so small that their significance is lost to us, yet ample to collect and trap bacteria and fluids. Gravity also causes subsidence to the lowest part, for the time being. Strain everywhere predisposes to inflammation, and some parts of the peritoneum are more subject to strain than others—this is Mr. Lane's whole thesis.

All these and other factors determine that certain parts of the peritoneal covering shall be more damaged or irritated than others, hence thickened by bands or membranes,—or, as Mr. Lane indicates, *supplemented* by bands not in direct cohesion with the normal mesenteries. Edema and effusions (see later) are the foundations upon which these supplementary membranes are built.

We have all seen in the pelvis encysted exudations associated with inflammatory processes of purely genital origin forming definite cysts, some free, but most adherent by a form of pedicle to the broad ligament; what is the cyst-wall and whence its origin? It is at first simply fibrin derived from the exudation, but in chronic,—i.e., old,—cases definite flattened cells similar to endothelium appear; this endothelium is derived from the adjacent peritoneum and, possibly, other fibroblastic-forming fibrous tissue, which has migrated or floated downward in the lymph as the result of gravity. Thus, without direct continuity with the peritoneum, but derived from it, definite membranes form; and although Mr. Lane makes a great point of the fact that his membranes begin to develop at parts most distant from the bowel,—i.e., the peritoneal reflections,—it is at such parts that fluid does stagnate and on such fluid or œdema endothelium can live and organize. It must be remembered, also, that the endothelium of the peritoneum is not of uniform structure, and may not have identity of functions.

I have operated upon cases of intestinal obstruction to find the whole small intestine completely obscured by a sheet of dense membrane, one-sixteenth of an inch thick, which was spread over the coils, and bound them inextricably together. On carefully dissecting through this membrane one finds that the *sides* of the coils are free from adhesions in a very large degree, as also is the mesentery (there *are* adhesions of both), and I have wondered why the free,—i.e., the ante-mesenteric,—border of the bowel should be the part most affected

and adherent. Whatever the real reason, it is in all probability the same cause that makes Mr. Lane's bands be attached to the antemesenteric border, and may be a mechanical or *secondary* result.

These cases (five) have been unable always to give a clear history indicative of tuberculosis, but in two cases old calcified glands in considerable numbers lead me to the belief that these two may be looked upon as undoubtedly tuberculous, and that probably the other cases were of a similar nature; hence we know on this kind of evidence, and from operative and postmortem knowledge, as well as from the irrefutable evidence of animal experiments, that bands and membranes can be evolved by the process of inflammation.

In only one of five such cases have I seen any gross evidence of systemic toxæmia, such as the theory of mechanical obstruction by bands would lead one to expect (*i.e.*, until the complete intestinal obstruction); this man with marked systemic toxæmia had an intensely septic oral cavity, and died after the operation; nor was there grave delay in the passage of charcoal administered in the food of one of these cases, to whom I asked it should be given after the bands causing the obstruction had been successfully relieved, although some feet of lower ileum were still densely matted. In one, a blind hawker, a history of severe constipation was elicited. I operated upon him twice, and he died after the second operation.

I have gone into this subject at the discussion at the Medical Society this year, and will not pursue it further except to say that if ptosis of the viscera, due solely to the erect posture, in Mr. Lane's view, is the primary lesion followed by the development of bands, surely in 100,000 or more years human evolution should show occasional examples of a *permanent* attempt to remedy the defective nature of our visceral supports—seeing that less than two years suffices to evolve such remedies in a specific instance.

My own belief is that the ptosis is not a primary manifestation, but is itself secondary to undermining of the general health by toxæmia. It *may* occur in people solely from defective muscular development, and particularly in women; but this is the exception (whereas the lesion is very widespread), and it is clear to me that the visceroptosis is the result of prolonged *systemic* toxæmia, oftenest of gastro-intestinal origin, but *arising from any diseased organs or*

structures, which leads to progressive undermining of the general health, with muscular atrophy of the trunk muscles. We fail to remember that the sepsis may be of life-long duration, the visceroptosis recent. Although both may be life-long: if the toxæmia is associated with (or due to) gastro-intestinal sepsis alone, this intensifies matters by digestive disturbances which deprive the patient of sufficient nourishment; it also leads to atony of the walls of the hollow viscera which interferes with efficient emptying of their contents, the stomach in particular, thus increasing their work, and by sheer persistence of the weight of contents leading to displacement and possibly dilation. In this way we have all the essentials for visceroptosis.

Bronchitis by its toxæmia, its cough resulting in violent strain, loss of sleep, and the strain upon the heart, would be a grave cause of visceroptosis, and pregnancy by stretching of the abdominal muscles would be equally potent were the patient, from reasons already given, unable to recover her tone and muscular activity. Constipation and other causes of strain, as well as the wearing of corsets, play a part, as do many other things I have failed to mention.

Such, briefly, are my views on ptosis. The erect posture is only a small factor, and its influence must surely be expended first upon that big bag, the stomach, which ought to be displaced even before the cæcum. Yet Mr. Lane says the cæcum and those coils of the ileum lying lowest in the abdomen pull upon the *fixed* terminal four or five inches of the ileum, and this particular portion is prevented from displacement by the "evolution" of bands, though why this very limited portion should be so much more gravely afflicted by bands is not clearly stated,—except crystallization of forces—often the bands are some inches distant from the cæcum. The bands lead to kinking, hence small intestine stasis, this to duodenojejunal kinks, duodenal dilation, and lastly stomach stasis. (Certain kinks due to appendicular anatomy and pathology appear more rational.)

Whereas stomach stasis is probably an exceedingly early lesion, yet upon erroneous data he and Dr. Jordan base an important theory and an interpretation of X-ray bismuth meal pictures in conformity with his views.¹⁴ Stasis is only an incident in gastro-intestinal in-

¹⁴ See Discussion, Medical Society, *Clinical Journal*, Feb. 13, 1913.

fection, and it is common knowledge that some of the severest forms of intestinal toxæmia are associated with diarrhœa.

In what I have designated primary mucous colitis ¹⁵ the rate of transit of food along the small intestine is often abnormally rapid and absorption of food is abnormally great, yet toxæmia is extreme. In two cases of mucous colitis, after various medical and operative measures, I have been driven to perform ileocolostomy and colectomy. In both cases small frequent stools—diarrhœa—have resulted; I regret to state both patients remain uncured of symptoms and neurasthenia; neither is fatter, and the results are most disappointing—yet there is now most certainly no stasis. Thinness of the mucosa and whole wall of the intestine is the most striking feature of these cases and certainly there is much evidence that thinning of the mucosa means ease of passage of bacteria and toxæmia.

In well-marked cases of stomach ptosis with most pronounced ptosis of the large intestine (in many cases the hepatic flexure has been *below* the level of the iliac crest and the splenic flexure only just above this level) the cases react to bismuth meals as if suffering from ileal delay; after performing a gastro-jejunostomy the bismuth meals have been shown to reach *the splenic flexure within four hours, the ileum and transverse colon remaining as before,—i.e., in a condition of profound ptosis.*

Ileal delay, in my opinion, occurs in every case in which there is intestinal catarrh, especially cæcal; and, as catarrh is exceedingly frequent, it follows that ileal delay—so-called—is frequent; in fact, it is the exception to find an ileum which passes on its contents at the rate at which Dr. Jordan and Mr. Lane say it should do so.

Unbiased radiographers in Great Britain and abroad do not yet know what is the normal rate at which the ileum should empty itself; nor will a standard in the correct sense ever be established, as the chemistry or digestion is in all probability the most potent normal factor in determining the rate of flow, whether acting indirectly by hormones absorbed, or directly through the medium of the ileocæcal valve, or by stimuli set up at the orifice of the appendix—for Sir William MacEwen proved, in the Huxley Lecture at Charing Cross Medical School, that the ileocæcal valve is influenced to relaxation or continued closure according to the character and chemical reaction

¹⁵ *Proctologist*, March, 1912.

of the fluids which flow over its orifice. (See Discussion, *Roy. Soc. of Medicine*, 1913.)

If, therefore, the food in the ileum is insufficiently or inefficiently acted upon by the digestive juices, or its ingredients are otherwise abnormal, and samples of such food are submitted to the ileocæcal valve or the orifice of the appendix, *relaxation of the ileocæcal valve does not take place* and the onward peristaltic movements of the ileum are inhibited or stultified, and delay takes place.

We all know that one of the results of severe inflammation in most parts of the intestine is paralysis by tonic spasm¹⁶ and inhibition of muscular activity often leading to intestinal obstruction. When gastro-intestinal infection exists I have indicated, *ad nauseam*, that the cæcal mucosa is the part of the *intestinal* mucosa earliest affected (or most severely affected at an early date), and I know from postmortem examination that the folds and ridges of the mucosæ are the parts most affected and damaged, consequently I believe the lips of the ileocæcal valve are early involved in any inflammation present, and, as in all other parts of the tract, the result is paralysis or inhibition of the underlying musculature—at any rate, the effect is an attempt at minimal function, *i.e.*, rest.

The degree of the paralysis due to mucosal inflammation, which must almost immediately extend into the muscular coats as a cellulitis, depends upon the severity of that inflammation (as well as upon the nature of the infecting bacteria; some, like cholera, result in diarrhœa, probably from the toxins producing intense exosmosis of fluid). Generally, therefore, pseudo-intestinal obstruction, *i.e.*, delay, occurs in the onward passage of the contents of the ileum when the ileal effluent is inflamed. The bands may increase this delay, but I unhesitatingly believe they are themselves of inflammatory origin (pre-natal and post-natal).

In summer diarrhœa and cholera we find most pronounced shock associated with the most copious and rapid emptying of the bowel, so that stasis is not an absolute essential for gastro-intestinal toxæmia.

If bands are not due to mucosal disease leading to peritonitis; if the normal mucosa (and the mucosa is normal at the beginning

¹⁶ Peter Daniel, "Gastro-enteritis of Septic Origin, without Diarrhœa, Simulating and Surgically Treated as Peritonitis: with Notes of Four Cases," *Harveian Soc.*, 1913, also, Discussion, Medical Society, 1913.

of visceroptosis and stasis, according to Lane) does not absorb food toxins; if Lane attributes such slight importance to the bacteria present in the gastro-intestinal tract; given all these things, whence arise the toxins which produce the profound changes due to gastro-intestinal toxæmia?

The pharmacologists and chemists inform us that the most virulent food poisons are harmless in a normal intestine; and if in stasis cases the patients are deprived almost entirely of proteids, or given only the most easily digested and harmless, and still the toxæmia continues as profound as before, we must seek for some other cause of the toxins than proteid poisons; whereas, as I have stated, without any change in diet, removal of oral or nasal sepsis will, in the case of those infected therefrom as the primary focus, result in immediate relief, and often in complete cure, without further treatment.

So open to other interpretations are many of Mr. Lane's statements that one can find hardly one observation of his pathology safe from attack; thus, he describes the *first* part of the duodenum as the dilated part, whereas in Dr. Jordan's X-ray plates it is the *second* part which is seen and described. In the discussion at the Medical Society,¹⁷ I have shown many fallacies in the X-ray interpretations. At page 78 (Roy. Soc. Med. Report) Mr. Lane says that as a result of the bands or a prolapsed cæcum, etc., the ileum becomes obstructed and distended, AND ITS CONTENTS INFECTED BY ORGANISMS TO WHICH IT IS UNACCUSTOMED. Whence are these abnormal bacteria derived? Mere stasis will not generate them!

With regard to the opinions held by Mr. Lane, I am reminded of the curate's egg,—“good in parts,—and those parts are of a very high order of goodness; so much so, that I regret Mr. Lane has such a well-developed mental kink as to lead him to transpose the relative order of events, put the “cart before the horse,” and almost entirely to ignore the PRIMARY rôle that bacteria must play in the pathology of all mucous surfaces.

Such is the outlook of Mr. Lane and Dr. Jordan that no evidence will suffice to convince them that other causes may explain the presence of stasis, and I have a case now under my care, diagnosed by Dr. Jordan as ileal stasis due to kinks, and short-circuiting pressed

¹⁷ *Transactions*, 1913, and *Clinical Journal*, xiii, Feb., 1913.

upon him, which is proved to be a case of syphilis of the stomach.

Some few years ago I was called to a case, some thirteen miles from London, suffering from abscess in the right hip-joint. He had been in the Indian Marine, had various attacks of fevers and dysentery, returned home, was admitted for intractable constipation, etc., under Mr. Lane, who removed his appendix and freed adhesions about the ileum, and told the patient he must return at a future date for a further adhesion-freeing operation. He continued to see Mr. Lane from time to time, but the symptom of severe constipation, as Mr. Lane then called "stasis," was never improved.

I opened the hip abscess and evacuated a large amount of pus, in which the presence of a staphylococcus was demonstrated; there was no fetor, nor did culture show any form of intestinal bacteria (the *Bacillus coli* group) other than staphylococci. Within a few days of the operation the constipation improved, and a month or two ago he wrote me saying he was in excellent health, *and had had no trouble of any kind with the bowel*. This is now some years subsequent to the hip operation. Will Mr. Lane explain what has happened to his ileal bands and kinks?

Mr. Lane says, page 116, "If one could prevent the formation of adhesions the removal of the large bowel would involve no risk whatever to life. The only risk of short-circuiting or removal of the large bowel is the formation of adhesions."

This, of course, is child's talk, and quite unworthy of Mr. Lane. We know that the minor operation alone has been fatal from sepsis, while at least one of Mr. Lane's private cases succumbed to pulmonary embolism following thrombosis of the iliac vein, and that this operation, like all others, has definite risks.¹⁸

I have a nurse now under my care who developed acute colitis which became chronic and rendered her unfit to follow her occupation, so I advised her to have a short-circuiting performed and at the same time an appendicostomy.

She did splendidly, no sign of sepsis about the laparotomy incision nor the outer part of the appendicostomy incision. There was absence of healing from want of apposition of the tissues about the protruding appendix, but no suppuration from infection.

¹⁸ Sir J. Bland Sutton on "Thrombosis after Laparotomy," *B. M. J.*, 1913.

(I do not cut off appendices when I perform the operation, but after the whole wound heals.)

Her bowel acted spontaneously on the fourth day, and she felt exceedingly well. Yet, with no warning, this young, strong, and otherwise healthy girl, except for the colitis following (cured) oral sepsis as the primary focus, at the end of eight days developed thrombosis or paraphlebitis of the iliac vein. She has done well, and the bowel acts usually twice a day, sometimes once; she has no pain or other discomfort in the intestine.

I make a great point of uniting the severed iliac mesentery most carefully to the side of the mesorectum, beginning on the posterior abdominal wall, so that it is impossible for any hernia to form, and I observe that the coils of ileum may readily slip over the lowest portion of the small gut. Yet in two cases in which this was done for mucous colitis, diarrhoea has resulted; so that intermittent kinking is not the sole cause of repeated actions of the bowel in these cases; of this point I feel sure.

The action of the last kink in the hierarchy of kinks, that at the lower end of what used to be called the sigmoid but is now called the pelvic colon,—situated, that is, at the upper end of what Mr. Lane calls the pelvic colon (which name he seems to apply to the true rectum),—is a totally new function; namely, to prevent the *ascent* of the *fæces*. “When the stool passes into the rectum its presence in the pelvis incommodes the other pelvic organs, *and in the absence of a well-developed kink*, if it is not soon voided, it *passes upward into a more commodious part, namely, the sigmoid.*”

Here an *acquired* band is given credit for a **PHYSIOLOGICAL** function.

In a paper on Hirschsprung's disease¹⁹ I have attached great importance to the grave disturbance which may arise from slight abnormalities of structure at the anal outlet or in the true rectum causing interference with the normal expulsion of *fæces*, so that I am not adverse to the aim of attributing effects to mechanical causes; but to attribute to an acquired band a physiological action is a much more doubtful proposition.

* “Idiopathic Dilatation of the Rectum, with Notes of Two Cases,” **INTERNAT. CLINICS**, vol. ii, 1909.

The whole statement is unsupported by any evidence, and is on the face of it unlikely, but it shows Mr. Lane's trend of mind.

On page 116, Mr. Lane says: "To me the formations of adhesions (after colectomy) and their subsequent behavior are somewhat of a mystery, except in so far as I believe they are due to sepsis in some form or another."

What does he mean? To any ordinary surgeon the mystery is why adhesions do not form after the slightest manipulations. On page 115: "For some reason the free division of these bands and membranes occasionally results in the production of a peritonitis which may cause serious anxiety." So much so that Mr. Lane says the risks of short-circuiting are less than of division of these bands.

Is it possible the bands are largely infected with bacteria? There must be some such reason for the soiling of the cavity, otherwise why should peritonitis arise?—a complication so rare in the operations of short-circuiting and colectomy (in Mr. Lane's hands), yet so gravely does he infect the abdominal wound in short-circuiting, even, that special treatment (by fomentations) is undertaken to combat it.

Pages 112 and 113: "After the eleventh day the character of the record alters, and instead of the temperature every four hours, with its record of many variations, only night and morning temperatures are recorded, and we know how fallacious such records may be."

Are the "spikes" due to stages when the bowel is confined, and the "valley" to stages when the bowel acts? Because we know that in ordinary cases rises of two degrees in temperature are not uncommon when the bowel is confined for three days, and that a brisk purgative will bring the temperature down to subnormal.

I do not think these particular charts are so very striking. No doubt, in the further course of this discussion, we will have charts of similar nature from the vaccinists who will claim striking results from their favorite methods. A mere uterine douche will produce more striking results in reducing a temperature than the record now under observation.

Page 109: Of tuberculosis (of joints?), rheumatoid arthritis, or Still's disease, he says: "I do not think it is possible for either of these diseases to attain a foothold except in the presence of stasis (excluding wound infection)."

Any one with postmortem experience has seen tuberculosis result in death in infants a few weeks old. I have twice seen advanced appendicular tuberculosis cause death in infants of three months of age. In the history of these infants, both fed on natural cow's milk, no constipation had existed, but, on the contrary, laxity with a tendency to diarrhœa was present.

Mr. Lane entirely overlooks intra-uterine existence and the pre-natal diseases, of which tuberculosis is one. Peritoneal adhesions are often found in the fœtus. Here there is no visceroptosis, and posture is in favor of the viscera. What of tuberculosis set up through infected glands in the neck, etc.?

Page 97: In drawing deductions from Carrel's investigations and applying them to his own particular purposes, Mr. Lane is again most one-sided. Carrel's tissues cease to live or grow unless the serum in which they are placed is renewed or replaced. Surely we had an analogy on a colossal scale in the Black Hole of Calcutta! Effete products must be removed, and nourishment must be supplied; but to narrow down the subject into the statement "death of the tissues took place obviously because of imperfect drainage, JUST AS OUR BODIES AND TISSUES BECOME VITIATED AND DIE FROM CHRONIC INTESTINAL STASIS," is illogical; it is Mr. Lane's partial truths which are so disconcerting. The bowel is not the only effluent of our effete matters. Urinary effete products or those of respiration would destroy life much more quickly than the most severe natural products of intestinal stasis, although I am excluding infection from the former effluents while including them in the latter.

Here again Mr. Lane is too narrow and parochial, and I need not follow the argument into the realm of the ductless glands.

Page 106: "After short-circuiting, adenomata of the thyroid and breast disappear." Solid growths disappear? We can understand cysts disappearing, also that malignant disease very occasionally disappears spontaneously:

Page 101: Uterine infection and diseases are attributed to ileal stasis. As I have indicated ²⁰ and teach, every organ which is lined by a mucous membrane and has an outlet to the surface of the body, directly by a duct or indirectly through the medium of some other mucous tract, numbers amongst the diseases affecting it *chiefly* what

²⁰ "Diseases of the Orifices of the Body," *B. M. J.*, Jan., 1910.

may be called SEPTIC diseases, and these gain access to the organ *via* the duct.

Bond, of Leicester, has written a second most instructive paper²¹ on the mucous streams. In so far as disease in any part of the body reacts injuriously upon the body in general, so stasis plays a part in *conducting* to uterine infection, just as uterine infection *conduces* to intestinal infection and stasis.

Mr. Lane might himself assimilate his own advice to "grasp broad principles." He says that in young women with stasis pregnancy leads to improvement in the general health, simply by mechanically raising the sagging bowel, stretching the bands, and so improving the effluent from the ileum.

He quite ignores the mental and moral influence of marriage and the physiology of pregnancy; also, the care taken, generally including rest, during this condition.

As regards cystomata of the ovary giving rise to improvements identical with those of pregnancy, I beg leave to ask for greater evidence than a mere statement.

Page 103: Lane gives too much credit to the expulsive action of the abdominal muscles in the process of defecation; the expulsive force of the involuntary muscles is so overwhelming that without any voluntary abdominal exertion the bowel will expel its contents, whereas the most powerful efforts of the abdominal muscles fail to expel the contents of the intestine, other than a firm dry stool lying immediately above the anal canal; *i.e.*, well in the grip of the levatores ani.

TREATMENT OF GASTRO-INTESTINAL TOXÆMIA

In treatment we include PREVENTION, and here the causation is of vital importance. If the chief or only cause of intestinal toxæmia is the erect posture, the outcome of civilization, then we may say farewell to prevention, and herein is the hopelessness of Mr. Lane's hypothesis,—the disease has already developed, so to say, before we can prevent it.

If, however, the main cause is bacterial infection, particularly if due to such preventable causes as oral, nasal, and other *accessible* primary foci, then we are in a very strong position, and before many

²¹ *B. M. J.*, vol. j, 1913.

generations intestinal toxæmia will be a comparatively rare disease, instead of being the most prevalent, as I believe it to be now.

A still more close devotion to INFANT and children's hygiene, school clinics, classes for the instruction of children in teeth-cleansing (such as I know several school mistresses have instituted with the greatest success), the earlier resort to the practitioner, and the education of the latter in these small ailments which lead to such big results, and I know of no way more direct to this knowledge than to insist in the curriculum of medical tuition upon a course of dentistry, limited in its scope, and of the nature of demonstrations, without any attempt at mechanical knowledge. The pathology of the mouth is the same as general pathology; it perhaps has certain applications and modifications not met with in other parts of the body.

It follows, from what has been stated in the course of this paper, that treatment of the developed disease lies in correcting all factors which add to the intestinal infection, or which decrease the resistance of the body,—diet, rest, holidays, massage, modified rest-cures, spa-treatment, suggestion, and what not; remembering that unless *the* essential cause—the gastro-intestinal infection—is treated, and efficiently treated, all accessory measures will at best prove but of temporary benefit.

It must also be borne in mind that there are other causes of profound systemic toxæmia, especially infection in the genito-urinary tract, which is so widespread as to be second only to gastro-intestinal infection, and this cause in particular must be sought for and dealt with.

I can honestly state, from close observation, that about 60 per cent. of all my out-patients need only radical dental treatment and the regular administration of laxatives to set them on the road to recovery. I do not say that other medicaments and methods are not used and hasten cure; but, failing the dental treatment, and despite all other remedial measures, cure will not result; or, if there is relief, it is but temporary and quickly evanesces; whereas, if the secondary results of oral sepsis are not entirely cured by *radical* dental treatment, still the degree of improvement exceeds that in which it is neglected, and the periods of quiescence are much more prolonged.

One of the things often, may I say, "thrown in my teeth" is the remark "all the teeth have been removed and the gingivitis has

been cured, yet the patient's joint (or what not) is very little better." As has already been stated, that may be true, but, nevertheless, the treatment was correct.

When endocarditis is set up in cases of rheumatic fever the subsidence of the rheumatic fever does not of necessity lead to the cure of the endocarditis. In such cases what degree of recovery takes place depends upon the amount and quality of the damage done to the valves and myocardium or the joint in question, yet no one would presume to say you must not treat the rheumatic fever.

Without the treatment of the primary focus or cause, recovery of the secondary lesion must be hopeless or indefinitely delayed; and I would like here to say that when physicians advocate the removal of infected tonsils during attacks of rheumatic fever (if possible, of course, at the onset, but, failing that, at any time during the course of the disease), I feel sure their cases will make more perfect recoveries, and in all probability much sooner, than when drug treatment alone is relied upon. I have shown that this has been carried out in cases of nephritis.

Fully 20 per cent. of the out-patients suffer as the result of urethral and vaginal sepsis; of multiparæ who have had many children almost all, in the hospital class, have genito-urinary infection of some degree.

When conditions such as Mr. Lane describes do exist, I can bear testimony to the advantages of ileocolostomy; but if Mr. Lane would not label all his geese as swans we would arrive sooner at that honest level which all methods of treatment sooner or later attain, and by no means more certain and more inexorable than the experience of the general public, *i.e.*, patients and their friends and acquaintances.

Instead of colectomy, which I will not perform unless the colon is the seat of actual ulceration or is bound to undergo gradual necrosis with grave danger to life, as in cases I have briefly referred to, I perform appendicostomy in conjunction with ileocolostomy, and am convinced this combination is the wiser and safer course to adopt. In spite of all precautions, the adhesions after colectomy may be most crippling in their results, and patients pathetically complain that they have had an operation which has given them new symptoms in addition to some of their old ones. We have as yet insufficient

data of the effect that short-circuiting the bowel *ultimately* has upon children in after-years.

A person with goitre which causes great deformity and inconvenience or danger will experience the most perfect relief after its excision; but if deprived of the whole organ the ultimate result is disastrous, of course, and sometimes it is impossible to know that the portion left is a functional part of the gland. In regard to the big bowel the effects are still to be learned. As to the very clear skin which these short-circuited people are said to acquire, it often strikes me that the skin looks like the skin of people who are "delicate," i.e., fragile, or sometimes like tuberculous people when they are not hectic.

I object to unadulterated laboratory deductions without clinical knowledge and continuous personal observation of disease. They usually mislead, and in nothing more than the subject under discussion. Think only of the changes in animal physiology, the errors that have held sway, that have been corrected, and the corrections refuted! Yet, after all, pathology is the physiology of disease, and if errors are so easy to make and so numerous in normal (!) physiology, how much more potent the margin of error in pathological physiology! That is one of the reasons why I consider the great bacteriologist, Metchnikoff, an unsound leader; another reason is this: Do you believe that any portion of our anatomy is useless? Because I do not, and the large intestine is no exception to this rule. Only a few years ago the thyroid, adrenals, and, more recently, the pituitary, were considered unnecessary, and to this day the spleen is looked upon as a luxury, while few recognize that the "vestigial" appendix attains its fullest development after birth, and is present in all animals in one form or another.

Until the advent of skilled clinicians versed in radiography it was held that duodenal ulcer resulted in delayed emptying of the stomach. We now know that the reverse holds good, and that food is ejected from the stomach at an abnormal rate. The reason for this is a physiological one; namely, that the presence of an ulcer in the duodenum gives rise to stimuli efficient to induce relaxation of the pylorus and muscular contraction in the stomach; the presence of chyme in the duodenum allays these stimuli for a brief instant, but since the stimulating factor—the ulcer—is so much more intense than

the normal stimulus it requires more frequent doses of chyme to lull it. This is also probably the reason why food allays the pain of duodenal ulcer. If, however, duodenal ulcer is the result of duodenal distention and stasis, as Mr. Lane believes, it is difficult to understand why food should allay the pain. One would expect it to increase it by its addition to the already "dilated and distended duodenum," which, Jordan says, "may be seen writhing in its efforts to empty itself."

Ileocectomy is equivalent to opening an abscess; it is a rapid drain; it is not a curative measure of *ileal bands* and *kinks*, but of intestinal infection.

VACCINES

It may be incumbent to express my opinion of this treatment in gastro-intestinal sepsis. I do not believe that vaccines alone can cure a pyorrhœa; with dental treatment "Yes," but then *efficient* dental treatment needs no aid; it suffices without vaccines or other general treatment. As to what efficient dental treatment means, "there is the rub": for my patients, commend me to the dentist who extracts freely and does not employ crowns, bridges, or other fixed, irremovable dentures.

But, then, of vaccine therapy in general I am a person of little faith, and believe that it is overdone, often increases illness, and, improperly administered, accelerates death. I avoid the treatment in all grave diseases, as I believe the vaccine only does good when very little toxæmia is present.

With the multiplicity of bacteria in the fæces, who is to apportion to each its moiety in affecting the symptoms, and when is it possible to say "This is the inciting bacterium"?

However, I am not going into the matter further, but conclude that the treatment of intestinal toxæmia is to cure the infection therein, not to short-circuit the ileum into the rectum, since this only relieves some of the *effects* of the infection, and is not a cure.

ALIMENTARY TOXÆMIA

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THE history of the progress of the infection of our alimentary canal with micro-organisms is very important, and must be thoroughly understood by those who desire to appreciate the practical bearings of the subject of alimentary toxæmia. Briefly, the life history of an hypothetical individual with regard to alimentary toxæmia may be set forth as follows:

As with the great majority of others, whilst the foetus is *in utero* the contents of the alimentary canal are sterile, and the physiological processes of digestion are inactive; so no chemical change is taking place within the alimentary canal, toxins cannot be produced, and alimentary toxæmia is impossible. But with birth, or soon after, organisms are introduced into the alimentary canal, and our life-long intestinal education is begun! Being unused to the products of the action of micro-organisms, the baby's tissues suffer. This is seen in the very frequent gastro-intestinal irritation of the newborn, breast-fed or artificially fed; also, perhaps, in the secretion of fluid by the peritoneum in the abdomen, seen when a patent processus vaginalis is present as a hydrocele. Should the baby's resistance overcome its alimentary toxæmia, all will be well. But should the actions of the toxins prevail, the child will get rickets, a result of the action of what may be called alimentary toxins on the growing tissues. Of course, alimentary toxins, or toxins absorbed from the alimentary tract, are not the only ones that can produce such deleterious action on growing tissues. Others might be absorbed from the tonsillar region. Still, our profession regards the alimentary toxins as by far the most important in the production of rickets.

Rickets is not the only result of severe alimentary toxæmia in childhood. Many other diseases might be mentioned; such as wast-

ing, thrombosis, osteoarthritis, and so forth. Indeed, by lowering the resistance of the tissues of the child alimentary toxæmia may be said to render the entrance of organisms to the body more easy. Thus it will dispose to tuberculosis, to mesenteric glands, and to an infinite number of diseases.

By means of this life-long education we learn to endure alimentary toxæmia until a certain amount of alimentary toxæmia becomes physiological to us and necessary to our well-being; our powers of resistance to such toxins increase and increase until, with mature years and equanimity, we can overcome such a feast as the "city banquet," the onset of diseases, such as tuberculosis and malignant diseases, is disclosed to us, and as with life our war with organisms begins and so, truly, are the seeds of death sown within us.

As life progresses the tissues of the alimentary tract are directly affected, and the rest of the body indirectly. The results of the organisms in the alimentary tract are known, and form different chapters, so to speak, in our book of intestinal sepsis. Appendicitis is at once the most frequent and dangerous result of intestinal sepsis. Colitis and ulcerative colitis are others. Later in life there are gastric and duodenal ulcers. All the affections mentioned at present affect primarily the membrane of the bowel. But the sepsis affects more than the membrane, as shown in the above, and in diarrhœa and intussusceptions. The action of the muscular coats may be interfered with, producing delay in the passage of the intestinal contents, constipation, or, as it has been called, "intestinal stasis." But, in addition to the inner and middle coats of the bowel, the peritoneal covering membrane may be irritated: in the young leading to the formation of a hydrocele, and in the older, adhesions. The results and treatment of the adhesions, and the kinks caused by them, have already been gone into by Mr. Arbuthnot Lane. In this place it must suffice that of my own experience I can tell you that some patients are vastly improved by such operations as short-circuiting or colectomy, with or without appendicostomy; others are neither better nor worse, while a small number are even made worse by any attempt at operation. In the excitement and heat of so large a discussion as this, points of practical issue are apt to be overlooked or buried in an accumulation of theories and scientific observations. That some patients are vastly improved by operation is, I *know*,

beyond doubt, and I *think* that improvement could not have been attained by any other means. Therefore, I would strongly urge that for our future progress data be suggested by means of which we can differentiate those who will be improved by operation from those who will not be benefited. This is very important from both the patient's and the surgeon's point of view. Surgeons owe many of their failures and their inability to benefit patients suffering from alimentary toxæmia to the considerable time lost before they decide to resort to operative treatment. And this brings me to another point which I would strongly insist upon. Alimentary toxæmia is a progressive disease, or, perhaps better, the results of alimentary toxæmia are progressive; so that, if the consideration of operative treatment is delayed, more and older changes (adhesions, mesenteries, etc.) will be encountered, and the surgeon will have still less chance of being able to benefit the patient. His inability to do so is not his, the surgeon's, fault, poor man! His the unfortunate result of delay; perhaps unavoidable, perhaps avoidable. And it must never be forgotten that the intestinal tract is only one of many systems of excretion whose shortcomings may give rise to auto-intoxication.

In conclusion I would insist that the terms alimentary stasis and alimentary toxæmia are not synonymous. People may enjoy well-being, and perhaps health, while suffering from intestinal stasis, *if the intestinal contents dry, and the micro-organisms consequently die*. But where the intestinal contents are *moist and organisms are abundant*, fermentation must occur, and alimentary toxæmia become sufficiently marked to necessitate treatment. A course of waters and purgatives may accomplish the result desired, provided no kinks or other variety of intestinal obstruction be present.

Thus, when alimentary toxæmia is recognized clinically, I would suggest that treatment by means of diet and purgation be begun. While it is in progress let an X-ray examination be made of the progress of the intestinal contents along the alimentary tract. If any obstruction exists, the surgeon must remove it. But his work "merely makes the paths straight," and afterward treatment by diet and medicines must be continued.

Surgery

INTERESTING SURGICAL CASES.

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CASE 1.—Perforated ulcer of soft palate, syphilitic (*Ulcus palatini molle perforata luetica*). L. G., female, colored, aged 25, occupation housework, reported in the Surgical Outpatient Department of the University Hospital, February 7, 1913, complaining that for the past month food has entered nasal cavity, and that she cannot articulate distinctly. Examination revealed a perforated ulcer one inch in diameter in the soft palate at the base of the uvula, through which the posterior wall of the nasopharynx is distinctly visible (Fig. 1). No satisfactory history being obtained, as is usual with this race, blood was immediately taken for a Wassermann reaction, which proved "strongly positive" (1 + units). To meet this indication the first intravenous injection of neosalvarsan was administered on the tenth day after the first visit, and was followed by the usual mercurial and iodide course. The second Wassermann, taken one week after the first injection, showed reduction to "weakly positive" ($\frac{1}{4}$ + unit). Two weeks after the first injection, the second dose of neosalvarsan was administered, and a week later the third Wassermann returned "positive" (1 unit). At this time, four weeks after the first visit and two months after the inception of the trouble, the perforation was reduced from one inch to one-fourth inch in diameter, and there was noticeable improvement in articulation. Two weeks after this note the third dose of neosalvarsan was given, and two days later the fourth Wassermann returned "medium positive" ($\frac{1}{2}$ unit). The fourth dose of neosalvarsan was given 18 days after the third, and the fifth Wassermann, taken nine days after this, was "medium positive" ($\frac{1}{2}$ unit), just the same as the fourth. A month later the perforation was $\frac{3}{8}$ inch in diameter. The epithelium had grown over the edge of the hole, and this was why it did not close entirely. The edge was de-epithelialized with a scalpel, and a No. 2 double chromic-gut suture passed wide of the opening to give it rest by controlling the active palatal muscles. Uranoplasty proved a failure, however, the stitch breaking loose. Nine days later the fifth dose of neosalvarsan was administered, and the sixth Wasser-

FIG. 1.



Perforated ulcer of soft palate; syphilitic.

FIG. 2.



Ulcer of tongue; tuberculous.

FIG. 3.



Syphilitic osteoperiostitis of phalanges of middle finger.

mann, taken nine days after this, was "strongly positive" (1 unit). The mercury was now doubled and the iodide pushed to higher dosage.

This proved to be a very refractory case of tertiary syphilis. The patient was treated for a period of four months, during which time she received five full doses (0.9 Gm. each, a total of 4.5 Gm.) of neosalvarsan, with a continuous mercurial and iodide course, but despite this the last Wassermann was just as positive as the first. We would like to have given a dose of neosalvarsan every week, supplemented by biweekly intragluteal injections of a soluble salt of mercury, but the patient did not report as regularly as we wished, as she lived in an adjoining State, and this race is notoriously negligent, believing that symptomatic alleviation is the equivalent of constitutional eradication. It will be noted that a Wassermann reaction was performed after every dose of neosalvarsan, and that at no time was the reaction determined after suspension of treatment. If it was strongly positive with the patient under the influence of specific treatment, how much more positive it would have been after a therapeutic suspension is conjectural. The seventh Wassermann reaction, made August 1, was medium positive ($\frac{1}{2}$ unit).

CASE 2.—Tuberculous ulcer of tongue (*Ulous linguae tuberculosa*). E. P., male, aged 42, white, occupation lens grinder, reported in the Surgical Out-patient Department of the University Hospital, February 28, 1913, presenting an ulcer on the right margin of the tongue 2.5 cm. from the midline at the tip (Fig. 2). Duration, seven weeks. With the tongue at rest in the oral cavity this spot contacted with the roughened edge of a tooth, and it was thought that a chronic infection had entered through an abrasion here, and, since the patient had had pulmonary tuberculosis during the past five years, this infection was in all likelihood tuberculous in nature, despite the statement of Ryall (*Brit. M. J.*, 1913, i, 698) that tuberculous ulcer is exceedingly rare, and is generally far back on the tongue. The ulcer, which was about 1 cm. in diameter, was excised *in toto*. Microscopical examination by Dr. John Speese revealed tubercle. It was upon this case that the suggestion of the author to induce anaesthesia in the anterior two-thirds of the tongue by infiltration of the lingual nerve with novocain-adrenalin solution below and behind the third molar tooth was based (*v. Surg., Gynec., Obstet.*, 1913, vol. xvii, p. 114). The anaesthesia was perfect, the patient experiencing no sensation either when the ulcer was ablated, or when its base was seared with the Paquelin cautery. Wound healed by granulation.

CASE 3.—Subacromial bursitis (*Fibrositis bursae subacromialis*). C. W. R., male, white, aged 67, watchman, fell upon his left shoulder six weeks previously, and has since been unable to abduct left upper extremity to right angle, owing to persistent pain. There is pain on forced abduction and tenderness below the

acromion. No effusion. A fly blister 4×2 cm. was applied horizontally to arm just below the acromion. Three days later he could abduct his arm to an angle of 45 degrees without pain, and the trouble rapidly subsided thereafter.

In his lecture delivered before the Harveian Society of London, April 19, 1913, Luff (*Brit. M. J.*, 1913, i, p. 757) says: "This condition, which explains the frequency of stiff and painful shoulders, is very apt to be mistaken for arthritis or fibrous ankylosis of the shoulder-joint, or for brachial neuritis. Severe pain as regards abduction and rotation is the chief symptom, and the pain may be so severe as to prevent restful sleep. The pain is often felt at the insertion of the deltoid . . ." He classifies this as a chronic fibrositis (of bursæ) "the essential pathological change of which is an inflammatory hyperplasia of the white fibrous tissue, associated with exudation and proliferation of the connective-tissue elements leading to swelling and thickening of the affected fibrous tissues."

Heavy inroads will be made upon the list of obscure shoulder-joint maladies by the detection of this fairly common condition. It is usually due to trauma, although gonorrhœa and syphilis must not be overlooked as causes. In the acute traumatic cases with effusion Flint (*Jour. A. M. A.*, 1913, lx, 1224) recommends aspiration through a Luer syringe. My case was subacute, and the blister acted very satisfactorily. The serum obtained by the blister may be made use of in complement-fixation tests for syphilis and for gonorrhœa. In advanced cases with more fixation the adhesions may be dissevered by forced manipulation with an anæsthetic, followed by massage and active and passive motion, and if these measures do not suffice, it may be necessary to dissect the bursa out. If it be remembered that the pain in abduction is due to "pinching" of the inflamed bursa between the greater tuberosity and the acromion, the symptoms will be more readily appreciated. A case was recently seen of neuritis of the circumflex nerve, but here the pain was lancinating and was not to the same extent influenced by motion, and there was an annular zone of tenderness around the humeral neck. This inflammation yielded within a week to a transverse blister, rest, and the administration of acetylsalicylic acid.

CASE 4.—Acute tenosynovitis of extensors of thumb (*Tenosynovitis mm. extens. pollicis acuta*). M. G., male, white, aged 30, landscape gardener, has

noticed for a week crippling of right thumb, with pain on motion, fatigue on use, and a "grating" sound. He described it as a sprained wrist. There was an oblong swelling which crossed the dorsum of the lower fourth of the right radius obliquely from within outward, and palpation revealed a very distinct leathery crepitation, very similar to "crunching" of freshly-fallen snow under-foot. The old method of treatment of this fairly frequent condition varied from the blind application of ichthyol to splinting for a period of three weeks. By applying a fly blister over the course of this swelling, and immobilizing the wrist-joint and thumb with a splint, the crepitation may be made to disappear within 24 hours, with complete resolution within a few days. Here again the serum abstracted by the blister may be employed for complement-fixation tests to determine the presence of syphilis or of gonorrhœa, which in occasional cases must not be overlooked as etiological factors.

CASE 5.—Acute traumatic neuritis of median nerve in palm. S. A., female, white, aged 46, housework, reported at the Surgical Outpatient Department of the University Hospital with the statement that two days previously she had run a needle into her palm, and was uncertain whether a fragment had broken off and remained in the tissues. There was a punctured wound in the middle compartment of the palm near its base, over the course of the median nerve, pressure upon which caused pain. No foreign body was felt, nor was any revealed by the X-rays. There was no sign of infection. Attention is called to this fairly frequent condition, in which after a punctured wound there is persistent pain in the absence of a foreign body and of infection, because upon superficial examination the pain is apt to be attributed to infection, and incision unnecessarily made. The palmar contents are too delicate and valuable to be needlessly invaded. Questioning revealed the fact that pain came on *within an hour*, and has remained of the *same intensity* since. Infection would scarcely manifest itself within an hour, and would increase in intensity until relieved. After rest with a splint and the administration of acetylsalicylic acid, 0.6 Gm. thrice daily, the neuritis disappeared within two days.

In dealing with a punctured wound made by a *clean* needle it is not so incumbent to convert it into an incised wound and to administer antitetanic serum as it is in wounds, particularly of the sole of the foot, made by a *rusty* nail. In this latter group of cases the serum should be routinely employed, and the tract of the nail made aërobic by incision to its depth.

CASE 6.—Syphilitic osteoperiostitis of phalanges of middle finger. W. E., male, colored, aged 30, laborer, reported at the Surgical Outpatient Department of the University Hospital, April 11, 1913, stating that three months previously he had received an infected wound of the middle finger of the left hand, which had not healed. The sinus did not conduct a probe to the bone, and there were no carious fragments. The soft tissues of the finger were swollen, but not acutely inflamed. Skiagram revealed thickening of the periosteum of the proximal and middle phalanges (Fig. 3). Wassermann reaction returned "markedly delayed negative," the patient having recently been under treatment for lues elsewhere. He furnished a syphilitic history.

This case belongs to that great group of sluggish lesions, characterized by the absence of vigorous *restitutio ad integrum*, the basis of which is so frequently one of the chronic granulomata, usually tuberculosis or syphilis. Another not so rare cause of delayed healing of infections is secondary invasion by the mycobacterium of diphtheria, which causes a dull, grayish fibrinous membrane. Now and then even malignant degeneration, especially in leg ulcers (Marjolin's ulcer), will arise. Therefore, if a lesion does not heal up in due time, there's a reason, in the exposition of which laboratory methods are of the greatest aid.

CASE 7.—Sporotrichosis of forearm. T. I., male, white, aged 48, machinist, reported at the Polyclinic Hospital, service of Prof. Morris Booth Miller, March 9, 1913, with the condition shown in the colored sketch (Fig. 4, frontispiece). He stated that a year previously a piece of tin was accidentally driven into the upper dorsal aspect of the right forearm, and that he pulled it out immediately. As shown by the sketch, there were areas of healed skin in places, and in others there were sinuses which extended down to the muscles, and which were lined by partially necrotic tissue, and bathed in thin pus.

Here we were dealing with a chronic, indolent process following upon trauma, which presented some of the characteristics of tuberculosis and of syphilis, but which did not exactly fit into the picture of either. Therefore, small blocks of tissue were removed from the lining of a sinus and subjected to microscopical examination. This showed the presence of circular and oval spores of the sporothrix. No mycelia were found in the tissues.

At operation the sinuses were thoroughly curetted and the patient put upon large doses of iodide of soda. At the end of two months all lesions had completely healed.

Sporothrix infections were first described by Schenck in 1898 (*Bull. Johns Hop. Hosp.*, 1898, ix, pp. 286-290), so that recognition of the disease is comparatively recent, and of late case-reports have been rapidly accumulating in the literature. The organism resembles a bush (mycelium) with its leaves (spores). To the branches of the mycelium the pear-shaped spores are attached by very fine pedicles. The spores become readily detached, and are more apt to be found than the mycelia. It grows on ordinary media, especially the sugars. It stains readily with basic dyes, and is not decolorized by Gram's method. Its invasion may be detected

FIG. 5.



Sessile wart of thumb.

FIG. 6.



Wart of foot.

FIG. 7.



Leg ulcer due to *Bacillus coli*, simulating syphilitic ulcer.

by sero-diagnosis and by complement-fixation, using the spore suspension as antigen.

The period of incubation in man averages a week. Suspicion of the disease, aroused by an infection of unusual nature and protracted course, should lead to its detection by laboratory methods, described above. Iodide of sodium is a specific cure for sporotrichosis, and with large doses healing may be complete within a month.

CASE 8.—Sessile wart of thumb (*Verruca pollicis*). J. B., male, white, aged 16, clerk, presented at the Surgical Outpatient Department of the University Hospital, February 17, 1913, exhibiting upon the dorsum of the left thumb, over the ulnar side of the interphalangeal joint, a sessile wart 1 cm. in diameter and 0.5 cm. in height, which had existed for 3 months (Fig. 5). It was desiccated with the high-frequency spark until charred. At the next visit, five days later, the wart was floating on a bed of serum, and was readily removed, leaving a healthy base. A large conical wart of the foot (Fig. 6) was similarly treated with equal success.

I have found desiccation to be a specific for warts, succeeding where other methods have failed. One or two treatments, a week apart, usually suffice for cure. Pain during the operation may be obviated by a drop or two of novocain-adrenalin solution injected about the base of the wart, but this is seldom necessary. Other successful methods of treatment are freezing with carbon dioxide snow (Pusey, *Jour. Cutan. Dis.*, 1910, xxviii, 353) and emanations from a bit of radium bromide (Williams and Ellsworth, *Jour. A. M. A.*, 1913, lx, 1697). Local applications of nitric or of trichloroacetic acid are uncertain and slow. Internally, the administration of desiccated thyroids makes for cure in some instances (Morris, *Brit. M. J.*, 1913, i, 1039).

I usually prescribe drops of the solution of arsenite of potassium, believing that warts, like herpes zoster,* are the expression of a trophoneurosis, since I have imagined that, when multiple, they occur along the course of certain nerves. Morris (*loc. cit.*) suggests that multiple warts are an error of development.

CASE 9.—Fracture of coccyx (*Fractura coccygis*). M. I., male, white, aged 52, hardwood finisher, reported at the Surgical Outpatient Department of the University Hospital with a history of having fallen upon his buttocks three

* Quite recently herpes zoster has been defined as "the eruption, the peripheral manifestation, of acute posterior ganglionitis" (Litchfield: *Jour. A. M. A.*, 1913, lx, 22, 1691).

years previously, since which time he has felt "weak" about the sacral region. Eight months ago he started laboring work, which caused pain about the sacrococcygeal region, spreading over the entire back if he continues to work. There is pain at the site of the coccyx on sitting down. Examination per rectum shows fracture of coccyx with displacement of tip forward. There is preternatural mobility.

The ordinary case of backache is too liable to be explained away by calling it "lumbago," and antirheumatic remedies ordered. Every backache has a definite cause, which may be toxic, static, or reflex, and every backache, which is too frequently dismissed as "lumbago," which means nothing at all, should be investigated by history and by physical examination with as much care as an obscure affection in the upper abdominal zone. A case which was almost dismissed in this trivial manner proved to be a perinephric abscess. It is true that all backaches are not indicative of a serious malady, for a large percentage are due to infection with *Micrococcus pyogenes* var. *polymyositis* (Fox, *Am. J. Med. Sci.*, 1913, cxlv, 6, 879), and many others, especially in laborers, to fibrositis of the lumbar fascia. Magical relief is obtained in this class of cases by wet-cupping,—deep puncture of the erector spinæ mass with a narrow-bladed bistoury, and abstraction into a cup of an ounce or two of blood. This patient was treated elsewhere for some time for hypertrophy of the prostate as a cause of his backache. Another patient—a negro, aged 30—complained of backache and of nothing else. Investigation revealed a very early lumbar Pott's disease.

The patient of the text required, of course, excision of the coccyx.

CASE 10.—Leg ulcers (*Ulcera cruris*). Though volumes have been written upon the subject of leg ulcers, yet if every surgeon would describe his methods in dealing with them there might be sifted out a more rational and uniform method of treatment. The three accompanying cuts (Figs. 7, 8 (frontispiece), and 9) illustrate the three common types. The first is not luetic, as its punched-out appearance might suggest, but is the result of a "barked" shin from a fall downstairs a week previously. The patient lived in squalor, and the contusion became infected with *B. coli communis*. There was much cellulitis, which gave to the sore a punched-out appearance. In fact, several student onlookers diagnosed gumma from superficial inspection. Pending bacteriological examination, and to be sure we were not dealing with syphilitic tissues, owing to the history of a stillbirth six years previously, a Wassermann reaction was made, but proved negative. This infection yielded readily to antiphlogistic measures, but had it occurred in the chronically-congested tissues from venous stasis in a patient with varicose veins, it would have spread more widely and been more

FIG. 9.



Ulcer of knee; syphilitic.

FIG. 10.



Tumor over the upper part of the anterior tibiofibular compartment.

FIG. 11.



Upon active extension of the foot, the bulging alters its shape.

FIG. 12.



Liquid glass dressing for fracture of phalanx of little toe.

obstinate to treatment. The next case has passed through such an experience, and the ulcers ran along sluggishly for some weeks before she came to my notice. Phlebectasia was not very advanced, but there was just enough infiltration at the base and periphery of the ulcers to prevent or delay their resolution. It seemed that were absorption promoted by suitably-applied pressure the tissues could be made to heal the ulcers instead of being just able to prevent their spread. The ulcers were accordingly made surgically clean, were dusted with calomel, and strapped as shown in the illustration (Fig. 8, frontispiece). This method, first suggested by Thomas Baynton, of Bristol, in 1792, was extolled by Moore (*Northwestern Lancet*, 1910; N. S., xxx, 21, p. 445), and is both rational and effective. Within a week the ulcers were transformed from a state of indolent and sluggish inactivity into rapidly epithelializing granulating wounds, the contrast between the pure blood-red and firm granulations and the broad bluish-white band of regenerating epithelium being so striking as to merit reproduction here in tints. Had scarlet red or basic fuchsin been employed, credit for the healing would have been unjustly awarded.

This and other observations lead me to believe that it is not so much a question of what remedy or drug we apply to the ulcer as it is of restoring to functional efficiency the superficial venous circulation and the absorbent lymphatic vessels. Means to this end are numerous, and range from simple elevation of the limbs to right angle and supported against the wall for 15 minutes before applying dressing (Pool, *Med. Rec.*, 1910, lxxviii, 192) to that radical operation which seems most appropriate for the given case. For ambulatory cases nothing can equal a spica gauze bandage of the leg and foot, in the meshes and in between the layers of which Unna's zinc oxide and gelatin paste has been painted (B. A. Thomas, *Univ. Penna. Med. Bull.*, 1910, xxiii, No. 8). The most obstinate cases, of course, are those of many years' standing, in which there is chronic subcutaneous fibrosis and osteoperiostitis. Such cases, to the best of my knowledge, if not luetic, are beyond hope of permanent cure, and can only be treated palliatively. The incidence of bone lesions, often luetic, in chronic leg ulcers has been emphasized by Coues (*Bost. M. and S. Jour.*, 1912, clxvi, 11, 414), and where suspected their extent should be revealed by skiagrams.

The third case (Fig. 9) is one of an ulcerous gumma of the skin and subcutaneous tissues before the knee. Its geographical contour is evident. Wassermann reaction positive. Under specific treatment the lower part of the ulcer healed in the peninsular form shown in the cut. It will be noted that this healing occurred just below the

line of greatest tension of the skin when the knee-joint is flexed, and that this latter part is healing more slowly. It was the absence of physiological rest that accounted for this, for as soon as the skin was immobilized by resin plaster strappings healing progressed rapidly, great improvement being evident at the next dressing after 24 hours. Wounds over the olecranon are sluggish for the same reason: a longitudinal strip of broad adhesive will make a wonderful improvement in them.

Prophylaxis of leg ulcers must never be neglected. Those whose occupations require long periods of standing should wear an appropriate buskin support from the moment phlebectasis is detected. Those recovering from debilitating disease, type typhoid, should take good care of their limbs; and oedematous legs in ambulatory patients should always be supported, at least by a spica bandage.

CASE 11.—Hernia of tibialis anticus muscle. The patient, male, white, aged 30, railroader, was injured in a train accident. Examination revealed a tumor over the upper part of the anterior tibiofibular compartment (Fig. 10). At first glance it resembles a neoplasm. It is a sharply-defined, irregularly oval bulging, at the margin of which the sharp, dense, resistant edge of the deep fascia may be felt. Upon active extension of the foot (Fig. 11) the bulging alters its shape, and shows that it is part of the contracting tibialis anticus muscle. The edge of deep fascia is now plainly visible. The patient was in no way inconvenienced,—in fact, he reported for another condition. If operation were necessary, if the edges of the fascia could not be approximated, then at least the rent could be obliterated by a piece of fascia lata.

CASE 12.—Rupture of plantaris tendon. R. R., male, white, aged 44, while stepping down from curb into street at Atlantic City Station felt in right calf a sensation of a sting of a bullet (*coup de fouet*), which caused him to turn quickly about to see "who struck him." He continued the trip to Philadelphia and walked in my office complaining of pain up and down the calf. Examination revealed linear tenderness along the course of a line corresponding to the plantaris tendon.

This is a typical history. Another case occurred in a colored laborer who, while carrying a hod down steps, turned about to see "who hit him in the calf with a stone," and, happening to see a stone nearby, enlisted some bystanders into his cause and spent quite some time in a futile search for the imaginary miscreant. Though the injury is trivial, yet it should be borne in mind that serious trouble may be excluded and appropriate treatment applied. The history is so characteristic that a correct diagnosis is certain.

By way of treatment, strapping of the calf or the application of a firm muslin spica for a few days usually suffices.

CASE 13.—Liquid glass dressing. One morning early in the year, a patient came into my office with the statement that he had stubbed his toe while dressing. Examination revealed a fracture of the proximal phalanx of the left little toe. The patient was a butcher, and requested a dressing that would not interfere with his wearing a shoe and attending business. I selected liquid glass as the most suitable immobilizer, and began by putting extension upon the toe by pulling upon adhesive strips placed along its sides. Then a gauze spica of the toe was applied, and its meshes encircling the toe and extending a short distance beyond its base onto the dorsum were filled with liquid glass (sodium silicate), as shown in Fig. 12 (dark area). The solution soon stiffened, and within a few hours was dry and hard. He was then advised to purchase a "gout shoe," by means of which he was enabled to attend to business with great comfort. At the end of three weeks the dressing was removed, and the line of fracture ossified without deformity.

Used in this manner, liquid glass forms a surprisingly light and very cheap immobilizer and support. It is an ideal dressing for conditions in which a gypsum case is indicated, but is too heavy: for example, simple fracture of the shaft of the fibula in its middle three-fifths,—a fracture that is commonly due to contusion and that is liable to be overlooked unless suspected, as localized "wincing" tenderness and ecchymosis are usually its sole signs.

Sodium silicate dressings are equally available for fractures of phalanges of fingers. They may be removed by bandage-scissors or by solution of the glass with hot water.

ACUTE OSTEOMYELITIS OF THE LUMBAR VERTEBRÆ: DEATH FROM PYÆMIA *

BY ASTLEY P. C. ASHHURST, M.D.
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AND

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Resident Physician, Episcopal Hospital, Philadelphia

ON the afternoon of August 19, 1912, the ambulance brought to Dr. Frazier's service at the Episcopal Hospital a man in whose case the diagnosis of "epiphysitis" had been made by his attending physician. He was admitted with the Receiving Ward diagnosis of "sacro-iliac disease," made by Dr. H. E. Happel, then resident physician. We are indebted to Dr. Cecil D. Gaston and Dr. Paul Kleinhans for the careful ward-notes.

The patient was a locomotive fireman, aged 39 years; he was white, married, and had been born in the United States. There was no history obtainable of cardiac, renal, tuberculous, or malignant disease in his family.

His own *past history* was negative. He had always been healthy, with the exception of an attack of typhoid-pneumonia when 12 or 14 years of age, from which he made a complete recovery after six weeks. He had had gonorrhœa when a youth, and had a heat-stroke four summers ago. He used tea, coffee, alcohol, and tobacco in moderation.

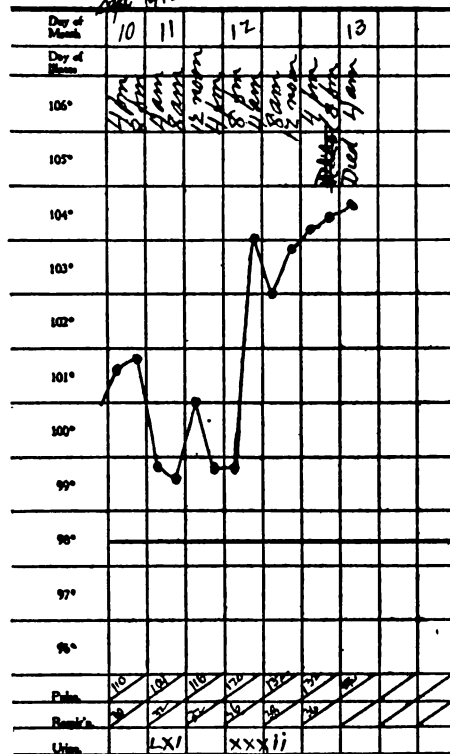
His *present illness* began August 8, 1912, eleven days before admission. He said that while at work on his engine during the night he felt a sudden pain in the right loin, as if from a sprain, but he was not aware of any sprain at the time. Previous to this he had not felt ill in any way; but it was learned later that at this time he had two furuncles on the left forearm, about his elbow, but these had disappeared in a few days.

* Read before the Episcopal Hospital Clinical Society, May 19, 1913.

On the night that he felt the sudden pain in his right loin he was able to continue his run, and returned to his home in Philadelphia. The next day (August 9) he suffered with generalized aching pain, most severe in the small of his back, and felt completely "down and out." At 1 P.M. he had to quit work.

CHART I.

Admission No. _____

Name John J. 912

During the next ten days he was treated at his home by two physicians, but without relief. The pain was constant, as it still was on his admission to the hospital, but was more severe at night. During the last few days it had been more localized in the back, especially in the small of the back on the right side. He had had occasional headaches. There had been no abdominal symptoms; he had vomited only once during his illness, and that was the result

of medicine he had taken; the bowels had been regular. *Two days before admission he had had a violent chill.*

Condition on Admission.—A fairly well developed and well nourished white man, apparently toxic, and suffering excruciating pain. He lay on his right side, with the thighs flexed on the abdomen. His face was flushed, his eyes were bright, but the pupils were normal, and no jaundice was visible on the sclera. His ears were negative. His lips and tongue were dry, and the tongue was covered with a thin, grayish-white fur. His breath was foul. The skin was hot and dry. There was no superficial adenopathy. The patellar reflexes apparently were somewhat increased, but the other reflexes were normal.

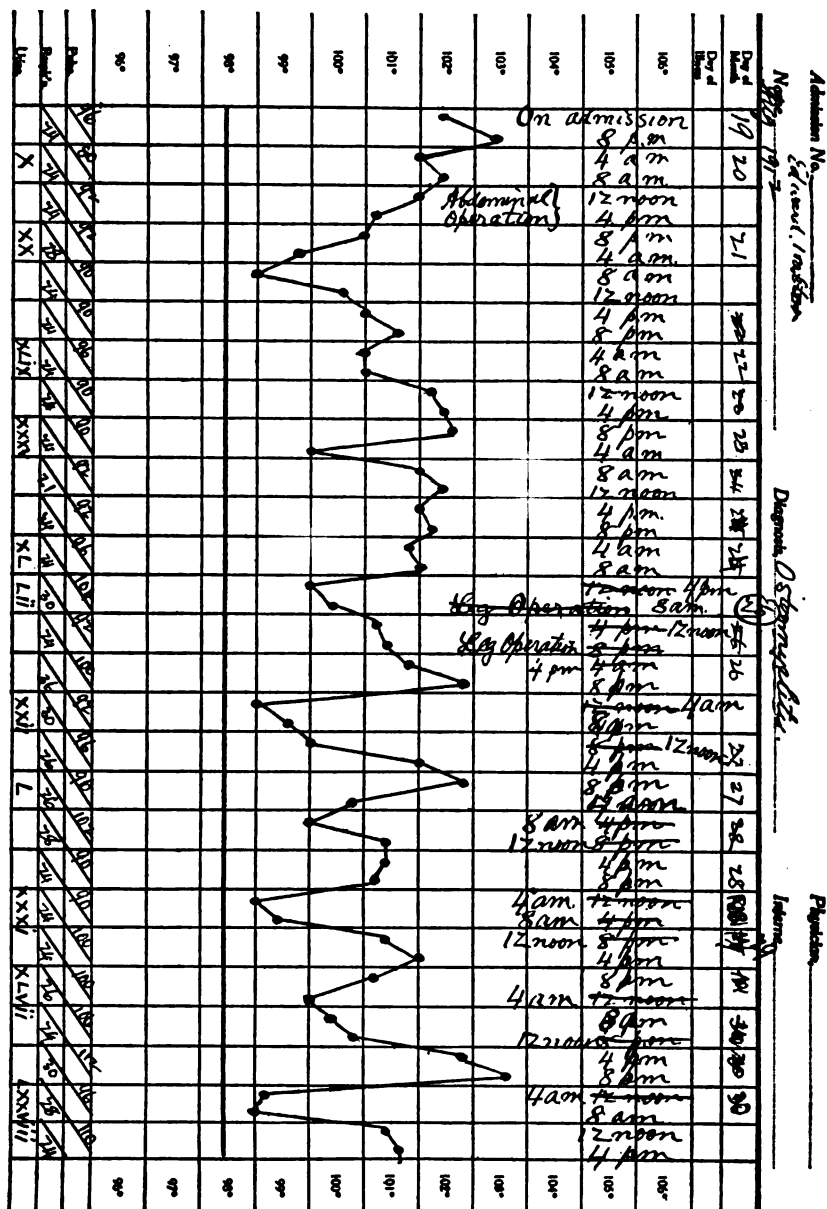
His pulse was regular, of fair volume and tension, and equal on the two sides; its rate was about 90 per minute. His temperature was 102.4° F., and the respirations were 24. The lungs were clear and resonant throughout, the heart sounds were rhythmical and of fair quality, and no murmurs were heard. There were no thrills, nor was there hypertrophy. The abdomen was negative: there was neither rigidity nor tenderness, nor were any masses palpable. There were no hernial protrusions. The spleen was not palpable. The liver dulness extended to the costal margin. The extremities were negative.

Over the small of the back, and up the vertebræ as high as the mid-thoracic region, especially over the right sacro-iliac articulation, extreme tenderness was present. It caused the patient great pain to be moved. No œdema, redness, or other signs of inflammation could be detected, and there were no signs of injury.

August 20. The patient passed a very bad night, complaining of intense backache. Morphine was given. His appearance was extremely toxic. Temperature 102° F. Pulse 90. Respiration 24. White blood-cells, 30,000. Differential count: polynuclears, 78 per cent.; mononuclears, 9 per cent.; transitionals, 2 per cent.; lymphocytes, 11 per cent. Urine: amber, acid, 1020. Flocculent sediment. Trace of albumin. No sugar. Numerous leucocytes. No pus. No erythrocytes, crystals, or casts. Many bacteria.

Examined at 12.30 P.M. by Dr. Ashhurst: The pain had shifted anteriorly, and marked tenderness and rigidity were present in the right hypochondriac region of the abdomen. Extreme tenderness was present midway between the gall-bladder and the appendix areas. The symptoms in the loin were less acute, but there was tenderness from the right of the epigastrium as far back as the kidney region. There was no tenderness over the lower thorax. There was

CHART II.



dullness to percussion in the right flank. Provisional diagnosis: Pus or gangrene in the abdominal cavity, either from a high retrocaecal appendix, or from a subacute or chronic perforation of the gall-bladder or duodenum, with retro-

peritoneal suppuration. Hæmatogenous infection of the kidney and pancreatic and pulmonary lesions were excluded. Osteomyelitis was not even suspected, in spite of the luminous diagnoses made before and just after admission. *Operation* by Dr. Ashhurst, 1 P.M. Ether. No masses palpable. Transverse incision from semilunar line outward at level of umbilicus. No evidences of peritonitis; no adhesions. Appendix not seen, but nothing abnormal was felt. The intestines, gall-bladder, stomach, and duodenum were negative. The right kidney felt normal to palpation. Nothing abnormal was discovered. The abdominal incision was closed in layers with continuous chromic catgut for buried sutures, and interrupted silkworm gut for the skin. The patient was then turned on his left side, and a trocar and cannula were thrust into the region of the sacro-iliac joint, with negative result. The puncture was sealed with collodion.

August 21.—The patient perspired profusely after the operation, and his condition seemed improved. The temperature fell gradually to 99° F.

August 22.—Temperature 101° F.; white blood-cells, 22,880. *Widal test negative.*

August 23.—Condition unchanged. Temperature 102° F. Pulse 90. Respiration 24.

August 24.—*Blood culture negative.* Still complains of intense pain in the back, especially over the right side; and tenderness in this region was apparent; otherwise the local examination was negative. The tongue was dry; the facial expression was that of septicæmia. He was seen in consultation by Dr. Richard S. Hooker, who examined the patient carefully, but could find no lesions; the heart and lungs were normal.

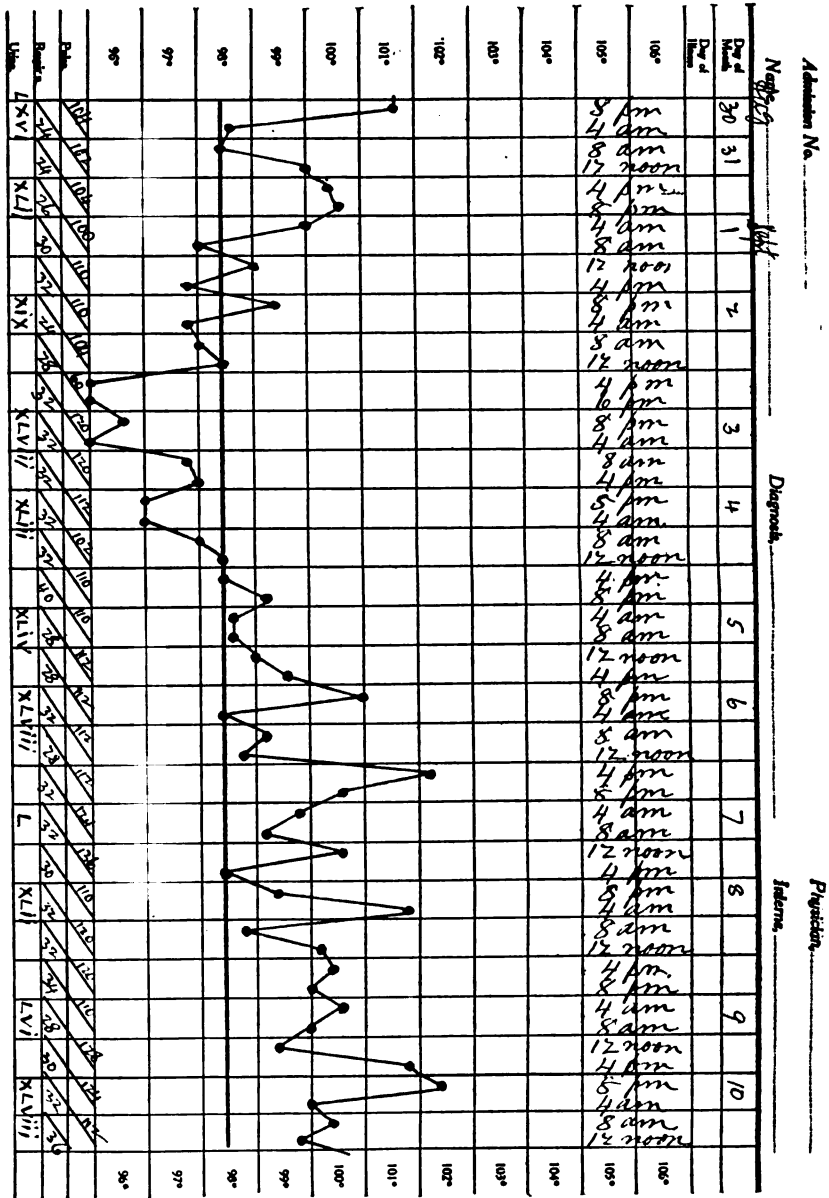
August 25.—The patient was more toxic; his mentality was dull, and he slept most of the time. Temperature 103° F. Pulse 100. He complained of pain in the left leg, and over the subcutaneous surface of the tibia midway between the knee and ankle was found a tender reddened area with tense skin; a sudden tap on the tibia caused much pain. No evidence of phlebitis.

Revised diagnosis: Osteomyelitis of tibia, masked by typhoid symptoms due to general infection. Differential blood count: polynucleurs, 85.6 per cent.; mononucleurs, 4 per cent.; transitionals, 0.3 per cent.; lymphocytes, 10 per cent.

Second operation, 2 P.M. (Dr. Ashhurst). Ether. Esmarch anæmia. Incision over subcutaneous surface of tibia through oedematous tissue down to bone. Periosteum incised and reflected from cortex. No sign of inflammation of tissues between skin and bone. No periosteitis. Cortex (apparently normal) removed with gouge, and medulla exposed. Marrow in lower half of tibia was more liquid than normal. Overhanging bone gouged away throughout lower half of tibia, and cavity packed with iodoform gauze. Leg was dressed before removal of Esmarch band. *Laboratory reports* (Dr. C. Y. White and Dr. Wm. H. Wadsworth): Smear and culture from bone-marrow; "large diplococcus, which appears to be a contaminating organism; another culture requested." Specimen of bone-marrow: "Bone-marrow slightly infiltrated with leucocytes; no evidence of specific changes."

August 26.—Patient seemed to be slightly improved. Temperature rose to 103° F. after operation yesterday and fell this morning to 99° F., but rose again by night to 103° F. Tongue was more moist, facial expression less anxious, and signs of sepsis less marked. Still complained of backache, and was unable

CHART III.



to sleep last night without morphine, which had not been required since night of admission. Urine: trace of albumin; pus present; otherwise negative.

August 27.—Condition unchanged. Temperature 100° F. Pulse 96. Respiration 24.

August 28.—General condition was apparently improved. Did not complain of such severe pain in back. Tongue more moist and facial expression less anxious. Complained of no pain in leg. Dressings on abdominal wound showed discharge, and a stitch abscess was found, opened, and drained. Eighth day since abdominal operation.

August 29.—*Wassermann test negative*. Did not complain to-day of any pain. Condition fair. Abdominal incision dressed and showed no pus. Leg dressed and apparently clean; fifth day since operation on leg. Temperature septic. Pulse 124.

August 31.—Abdominal incision discharging a slight amount of pus. Still complained of pain in back and did not look so well. Pus present in urine.

September 2.—Still some discharge from abdominal incision. Leg wound filled with thick clot, but not infected. Complained of more pain. Pulse rapid, weak, and intermittent. Blood count: white blood-cells, 34,080. Differential: polynuclears, 85 per cent.; small lymphocytes, 11.3 per cent.; large lymphocytes, 3 per cent.; eosinophiles, 0.66 per cent.

September 3.—Feels and looks better. Still complains of great pain in back, now on left side. Temperature subnormal. Pulse 120. Respirations 32. Seen in consultation by Dr. H. C. Deaver, who made a diagnosis of pyelitis. Urine report: amber, 1024, acid; heavy flocculent sediment; heavy trace of albumin; no sugar; few round epithelial cells; four leucocytes to field of microscope; no erythrocytes. Amorphous urates. No pus. Many bacteria.

September 7.—Urine: amber, 1014, acid; occasional erythrocytes; pus present; many bacteria.

September 9.—Rested quietly, condition about the same. Still some discharge from abdominal wound. Leg wound not infected. Dulness over bases of both lungs, more marked on left, with lessened tactile fremitus and vocal resonance, and breath sounds weak. Diagnosis, pleural effusion. Fluid aspirated from pleural cavity. Laboratory report: smear negative, culture negative.

September 12.—Much weaker, but complained of no pain. Pleural effusion now extended to middle of scapula on the right and to angle of scapula on left. Heart sounds were very weak.

September 13.—Temperature 104.4° F. Pulse 120. Died at 5.30 A.M.

Autopsy, September 13, 1912, 11 A.M. (6 hours after death), by Dr. William H. Wadsworth for Dr. C. Y. White. (*Abstract*.)

Pathological diagnosis: chronic fibroid pleurisy; acute fibrinous pleurisy; miliary abscesses of right lung, heart, and kidneys (metastatic); congestion of lungs; fibrinous pericarditis; chronic cystitis; congestion of liver, spleen, and kidneys; *double psoas abscess*; *osteomyelitis of lumbar vertebrae*.

Lungs: several very small abscesses in lower lobe of right lung. Peritoneum: glistening; no adhesions; no exudate. Stomach, intestines and appendix normal. Liver: slight fatty change and increased amount of blood. Gall-bladder normal. Pancreas normal. Kidneys: both dotted with miliary abscesses. Bladder: chronic cystitis. Spleen congested. Adrenals normal. Abdominal wall: transverse incision to right of umbilicus. Left tibia: incision over lower third. Mesenteric lymph-nodes and retroperitoneal space normal.

Double psoas abscess: on right scarcely apparent, except as slight bulging in iliac fossa; when opened, found to extend to Poupart's ligament. On left not apparent until opened. These abscesses had not ruptured. Cultures made

from them showed staphylococci. The bodies of the lower lumbar vertebræ were bared and eroded, but there was no apparent involvement of the sacro-iliac joints. Cultures from all organs of the body (heart, spleen, liver, kidneys) showed staphylococci, the same as the growth from the two psoas abscesses.

Osteomyelitis of the vertebræ is a rare condition. Up to 1906 Donati (*Arch. f. klin. Chir.*, 1906, lxxxix, 1116) could collect only 56 authentic cases, exclusive of those involving only the sacrum. The most complete recent review of the subject is that given by Henle (Bruns, Garrè, u. Küttner, *Handb. d. prakt. Chir.*, Stuttgart, 1912, Bd. iv, i, 115).

According to Henle, E. Fränkel has found in the bodies of the vertebræ at autopsy, both microscopically and by culture, the following organisms: *Diplococcus lanceolatus* in pneumonia. *Streptococci* in erysipelas, pulmonary abscess, and diphtheria. *Staphylococci* in cases of phlegmons and acute suppurations. *Typhoid bacilli* in cases of typhoid fever.

Quinke thinks that the vertebral marrow plays the same rôle in infections as does the spleen; and with the findings of Fränkel noted above it is strange that vertebral osteomyelitis is so rare. In the majority of such cases it is evident that resolution of the minute local lesions (hemorrhages, necroses, increase of giant-cells, and accumulation of lymphocytes) occurs before they produce symptoms. But this is not always their course, and sometimes, especially under the influence of trauma, they develop and produce more or less definite symptoms. Nevertheless, vertebral osteomyelitis forms only about 2 per cent. of all cases of osteomyelitis.

Of Donati's collected cases, the age was mentioned in 52 patients: From 1 to 10 years, 15 cases; from 10 to 20 years, 24 cases; from 20 to 30 years, 11 cases; from 30 to 40 years, 1 case; from 40 to 50 years, 1 case. Thus 75 per cent. of the cases occurred in patients less than 20 years of age, and 36 males (68 per cent.) and 17 females (32 per cent.) were recorded among them.

The region of the spine involved: Lumbar region, 26 cases; 17 deaths (65.4 per cent. mortality). The thoracic region, 18 cases; 5 deaths (27.7 per cent. mortality). Cervical region, 9 cases; 4 deaths (44.4 per cent. mortality). Diffuse, 3 cases; 1 death (33.3 per cent. mortality).

The portions of the vertebræ affected: Bodies of vertebræ: 14

cases; 11 deaths (78 per cent.). Other parts of vertebræ: 37 cases; 13 deaths (35 per cent.).

Usually there is caries rather than necrosis; sequestra, if formed, are very small, and are easily evacuated through an incision or a fistula spontaneously formed. Spontaneous rupture of an abscess externally never occurs except when the part affected is in the posterior portions of the vertebræ, such as the laminæ or spinous processes. Rupture into the spinal canal may occur, and has caused paraplegia, as in Donati's own case; if the dura is penetrated, meningitis, or even myelitis, may result (Riese). Abscesses usually follow the course taken by similar collections of pus in tuberculous spondylitis. Anterior abscesses resulting from disease of the vertebral bodies are retropharyngeal from cervical osteomyelitis; mediastinal from thoracic disease, and psoas abscesses from lumbar disease. Rarely are the costotransverse joints invaded, or the intervertebral articulations.

Predisposing Causes.—Trauma was noted in only 7 cases, and almost all of these with invasion of the lumbar vertebræ. An atrium of infection could be found in 16 per cent. of the reported cases: in one case an abrasion of the skin; in most cases such affections as felons, abscesses, furuncles, anginas, or old suppurating osseous foci elsewhere in the body.

The *symptoms* are at first merely those of any severe acute infection. Seldom, according to Henle, until the third or fourth week does a palpable abscess develop when the vertebral bodies are affected. Abscess formation is easier to detect if the laminæ are involved. Psoas abscesses due to vertebral osteomyelitis have never yet been diagnosed during life; death occurs from pyæmia before they become palpable.

The *prognosis* is grave. In various collective statistics the mortality has varied from 48 per cent. to 71 per cent. As already noted, in Donati's series, which is the largest, the mortality of cases where the bodies of the vertebræ were involved was 78 per cent., and only 35 per cent. where the posterior parts were affected.

The *treatment* involves evacuation of the abscess when one is detected. A retropharyngeal abscess should be opened through the neck; a mediastinal abscess by the operation of costotransversectomy, and a psoas abscess through an incision similar to that used for

ligation of the common iliac artery (extraperitoneal). Heidenhain operated by costotransversectomy with success.

If the patient survives, secondary operations often are required to secure better drainage. The possibility of the formation during convalescence of a kyphos from collapse of the vertebral bodies should be remembered, and measures taken to prevent deformity.

In the case of the patient whose history is reported to-night, it seems, looking backward, that it should have been possible to make a correct diagnosis during life. It was, of course, recognized that he was suffering from an acute, severe, and generalized infection. The onset, as if from injury, though he had no knowledge of trauma; the previous existence of an atrium of infection (furuncles); the high temperature and marked leucocytosis, all pointed to this, while the persistent localized pain indicated the lumbar region of the right side as the seat of disease. When the next day the physical signs had shifted toward the abdominal cavity it was thought pus had been located. The absolutely negative result of abdominal exploration and palpation of the kidney and surrounding structures through the abdominal wound diverted our attention from the lumbar spine, in spite of the two diagnoses indicating a suspicion of bone involvement which had been made before the patient came under our care. Finally, when on the sixth day after admission the patient complained of pain in his leg, in spite of his semicomatose condition, and when the local signs there indicated the presence of an osteomyelitis, we once more felt sure that the main focus had been located, and great was the disappointment at the negative result of the second exploration.

It is small consolation to think that death would have been the probable result even if the diagnosis had been made during life, or the abscesses drained; or even to find it recorded that never yet has such a condition been diagnosticated before death.

It is a constantly recurring mortification to a surgeon, and, what is much worse, it is a reproach to surgery, to find that, in spite of our advances in so many directions, every once in a while something turns up to remind us that we are no better than our fathers were.

THE USE OF CAMPHORATED OIL IN SURGERY

BY P. BAUDET, M.D.

Surgeon to the Toulouse Hospital, Toulouse, France

FOR a number of years we have been studying the use of camphorated oil in our surgical wards, and feel that its advantages should become better known. Lemaire, in France, and Barker, in America, have written on the toxic symptoms that follow the internal administration of camphor, even in small doses, while Trousseau cites the case of a lady poisoned with ten drops of the tincture of camphor. From a perusal of these papers, one might think the administration of camphor is unsafe, although these patients were given the drug by the mouth.

We have found, however, that when camphor is used in oily solution and injected subcutaneously, even in massive doses, it is quite innoxious; in this view all modern French and German writers agree. The camphorated oil used by us is composed of 10 per cent. of gum camphor dissolved in pure olive oil that has been washed in a strong solution of soda to remove all acids, after which the solution is sterilized. This is put up in little "ampoules," containing 10 to 20 Cc., and as many as may be necessary are broken previously to being used.

We make use of two methods: the hypodermic and the intraperitoneal. In order to demonstrate the value of camphorated oil given hypodermically, we will describe three types of cases that we see daily in our hospitals:

CASE 1.—A young man of eighteen is brought in, after meeting with an accident while working. His leg had been crushed by some machinery. He was not sent in immediately upon being released from the machine, but after some hours had elapsed. We received him in very bad state; there was vomiting, cold sweat, a pulse of 140, and a temperature of 103°.

We immediately injected 20 Cc. of camphorated oil (hypodermically) into the muscles above the wounded parts. We also injected a little gaseous oxygen under the skin and put on damp compresses. His pulse responded shortly after

the first injection of the oil, and in a few hours (this may be days, depending on the case) he was in a good state for operation.

CASE 2.—A man of fifty-eight with cancer in the larynx. He was in a weak state, but we were obliged to operate on him at once (laryngectomy).

The same evening we found him with a barely perceptible pulse of 150. Injections of camphorated oil were ordered. The second day there was a slight improvement. He then had a bronchial attack that left us little hope; however, we continued the hypodermics of camphorated oil, and in a week had him up and walking about the wards.

CASE 3.—A young woman was brought in after an abortion, probably criminal. She was in a miserable state generally, pulse 130, swollen abdomen, signs of cellulitis. As before, camphorated oil, and a cure in four days.

Not one of these cases presented the slightest sign of intolerance, and we now have records of hundreds of similar cases. We therefore feel authorized to declare this form of treatment to be quite harmless. A few hours after the first dose the smell of camphor is perceived on the breath; it is probably eliminated by the lungs. By the most careful analysis, we could not find it in the urine. The injections are not painful, and produce no local reaction.

Intraperitoneal Injections.—One of the greatest triumphs of modern surgery is to have undertaken to cure diffused peritonitis, which was formerly almost always fatal. Of late years the therapeutics of acute peritonitis have changed entirely, and yearly statistics now show a higher and higher percentage of cures in cases where formerly the very name of peritonitis was regarded as synonymous with death.

Much of this progress is due to the measures taken to put the organism into a state of maximum resistance to the reabsorption of toxic products from the peritoneum. The principal factor in the prognosis is the general intoxication of the organism, and our patients formerly died poisoned by the reabsorption of microbial products of the serous membrane more than by those of the intestines.

This reabsorption takes place chiefly in the lymphatics, but to a certain extent also in the blood-vessels. In 1863, Recklinghausen noticed that when a certain quantity of oil was injected into the peritoneal cavity the lymphatics about the diaphragm were in a little over an hour obliterated by the oil absorbed, and this obliteration persisted for several days.

We began taking advantage of these facts over two years ago, and started the use of camphorated oil, hypodermically injected.

This "varnishing" of the peritoneal cavity can be carried out by injecting the oil, and then using compresses to disseminate it all through the cavity; or, in certain cases, it can be simply poured in by a drain.

Of course, we use other modes of treatment recommended for such cases, among them, putting the patient into Fowler's position, collecting the liquids in the lower pelvis, etc.

We combat the gastro-intestinal infection by washing out the stomach, and by continuous injections into the intestines by Murphy's system, from above or below, drop by drop. Appendicostomy or cæcostomy is resorted to in some cases. We used at one time as much as 150 grammes of the oil in 10 per cent. solution. Two hundred to three hundred grammes have been used by Hoehne, without any bad results; on the contrary, there was in most cases a cure.

ANÆMIA FROM A SURGICAL STANDPOINT

BY HENRY T. BYFORD, M.D.

Professor of Gynæcology, University of Illinois, Chicago

THE problems that confront the young surgeon to-day are very different from those of a few years ago. Before the discovery of anæsthesia and the development of aseptic technic, the surgeon relied on rapid, skilful cutting and an ability to meet emergencies as they arose. The brilliancy of the surgery and the endurance of the patient were the things that counted most. The mortality of major operations was so great that patients were wont to wait until they knew they could not survive much longer before they submitted to them. But to-day the preparation for operation and the recognition of pathological conditions affecting the patient count for more than manual dexterity or readiness in emergencies. Conditions and complications are recognized beforehand, and we do not operate as a last resort, but choose our time and conditions. Our operations are more complicated, but their complexity is provided for, and time can usually be taken for the execution of a careful and finished technic.

The aspect of the subject which interests us to-day is related rather to the condition of the patient than to the details of the operation. I refer to anæmia. The postoperative treatment of anæmia has received much attention and leaves but little to be desired, but the pre-operative states of anæmia do not always receive the careful attention of the surgeon that their frequency demands.

My attention was first called to the prevalence of anæmia among gynæcological patients at the very beginning of my practice, and before it was customary to make a blood count. I continued the habit acquired in the dispensary clinic of giving an iron tonic to all delicate-looking gynæcological patients. In fact, I gave it to nearly all of the cases that came to me for local treatment, and found that most of them began to improve, and some of them felt almost well long before they could have been thus benefited by the tampons and tincture of iodine that I was in the habit of using locally. I also

noticed that strong washerwomen usually complained much less of pelvic pathology than women in the higher walks of life. As time passed I realized that anæmia and the conditions that accompany it either produced many of the symptoms or rendered the patients less tolerant of them.

Later, when performing major gynæcological operations, I experienced many surprises. I found that, while some patients would come from the operating table in profound shock, and would either show no response to treatment or would recover very slowly, others who had not appeared to be much stronger, if any, could readily be brought out of the shock, or would stand a long and bloody operation with little shock and make a quick recovery.

As our methods of diagnosis became more accurate I learned that the anæmia so often present was one of the most important factors in making this difference in resistance, and that different cases of anæmia show relatively different degrees of resistance. By making systematic examinations of anæmic patients, both with regard to the blood and the general conditions, I was able to distinguish between the good risks and bad ones, and could then proceed without fear to the performance of difficult or prolonged major operations upon the former, and take appropriate measures to improve the resistance of the latter.

A case upon which I have recently operated represents what would ordinarily be called a bad risk, yet she bore the anæsthetic and operation of separating extensive adhesions and the removal of an enlarged perforated appendix with but little shock or acceleration of the pulse. She had also recovered from an acute attack, with perforation, two months before without, so far as I can learn, much difficulty. She has been a so-called chlorotic from her youth. In the eight years I have known her, her complexion has been sallow, her lips pale, and her eyes surrounded by wide bluish areas. She told me that when she was young she was not strong, and that she usually recovered slowly from sickness or injury. Since I have known her she has never complained of symptoms except those caused by pathological conditions, and she has been able without help to do the housework for herself and husband. About seven years ago I removed her uterus and appendages for a small fibroid tumor and chronic inflammation of the ovaries and tubes with extensive ad-

hesions. The operation was a long and severe one, yet she stood it well and recovered promptly. I did not make a blood count at that time, but have done so several times since, and have never found the hæmoglobin above 70 per cent. except on one occasion when it was 80 per cent. At one time it was 60 per cent. A few days ago it was 65 per cent., and the systolic blood-pressure 116. Her erythrocyte count was always good, and has ranged between 4,500,000 and 5,000,000, usually nearer the latter figure. This high erythrocyte count and the fact that she carries a moderate amount of fat and has been able to lead an active life account for her good showing in the presence of a low hæmoglobin percentage.

The endurance acquired by this patient, which enabled me to classify her as a good operative risk, may appropriately be called compensation,—compensation for her anæmia. She had been anæmic long enough to acquire the anæmic habit, and the functions of the body had accommodated themselves to these conditions. “The proof of the pudding is in the eating,” and the proof of compensation is the fact that the patient has been able not only to take considerable active exercise without losing her feeling of well-being, but at the same time to retain her usual weight. And the fact that she displays such evidence of good health with a hæmoglobin percentage of 70 per cent. is proof that her anæmia is compensated for at that figure. It is the muscular endurance that counts more than any other one thing as evidence of compensation, and, other things being equal, the greater the amount of muscular exercise the patient can take with comfort the better the compensation.

I have a patient whose anæmia is compensated for at 45 per cent. hæmoglobin and 80 per cent. erythrocytes. Mrs. M. L. E., May 25, 1910, had a blood count of 4,380,000 erythrocytes, 7200 leucocytes, and hæmoglobin 43 per cent. I resected the ovaries for complete cystic degeneration of one and almost complete of the other. She went home after a prompt and uncomplicated convalescence, and returned in nine months with a count of 4,100,000 erythrocytes, 6000 leucocytes, and hæmoglobin 45 per cent. She had done what she could for the benefit of her health, and had lived a fairly active life with comfort, yet the blood count had not improved much. This was because the anæmic habit had been acquired, and had resulted in compensation. How long it will take her functions to overcome this

anæmic habit and establish a different status of functional equilibrium I cannot say; it may take years, during which time the blood picture will, I suppose, gradually or intermittently improve.

In a general way, therefore, we may say that there are five signs that, taken together, constitute fairly satisfactory evidence of compensation for chronic anæmia:

- (1) Muscular endurance sufficient for an active life.
- (2) Absence of symptoms due to anæmia.
- (3) Normal or nearly normal amount of fat.
- (4) Pulse of normal or nearly normal strength and frequency.
- (5) Blood-pressure from slightly below to normal or slightly above.
- (6) Erythrocyte count 4,000,000 or over.

Roughly speaking, we might say that the greater the muscular endurance and the better the blood-pressure, the better the patient will bear the operation in every way except the loss of blood. On the other hand, the higher the erythrocyte count and the more abundant the body fat, the better will the patient stand the loss of blood.

With regard to the treatment, it must be remembered that in these chronic cases with compensation an anæmic habit has been acquired, and it is impossible to raise the hæmoglobin percentage much above the figures that represent the compensation. An attempt to do this rapidly by means of large doses of iron and a system of forced feeding would have about the same effect as upon a healthy person,—*i.e.*, disturb their metabolism. Their habits and hygienic surroundings should be so regulated that they will be under the best conditions to outgrow the habit gradually. If, however, there is a deficiency in one of these signs of compensation we should try to restore what is lacking. If there is deficient muscular endurance, the patient should develop muscle by taking a gradually-increasing amount of exercise morning and afternoon, with an interval of two hours in the recumbent posture. This will also help a low blood-pressure. A tendency to emaciation or low erythrocyte count may be benefited by taking cream, cod-liver oil, butter, or extract of bone-marrow. A hæmoglobin percentage below 60 calls for iron, and should be raised as rapidly as possible above 70, or until it has reached the compensation figures.

A case of uncompensated anæmia is one in which the patient

cannot fulfil the ordinary duties of active life without symptoms that either cause her great discomfort or produce an increase of the anæmia. The signs are:

(1) Insufficient muscular development or endurance for an active life.

(2) Symptoms due to the anæmia.

(3) Emaciation.

(4) Soft and rapid pulse.

(5) Subnormal blood-pressure.

(6) Low erythrocyte count, usually below 4,000,000.

It is not necessary that all of these signs be present. An anæmic person of advanced age may, of course, have a high blood-pressure and hard pulse due to arteriosclerosis. One who lies down much of the time may not complain of symptoms, and, if she belongs to a family of fat people, may retain a presentable amount of fat. A patient with a low erythrocyte count may be called anæmic when the hæmoglobin is 80 per cent., while one with a nearly normal count may not feel the loss of hæmoglobin until it drops below 70 per cent. The importance of the hæmoglobin percentage should be estimated in connection with the erythrocyte count. A person with 5,000,000 normal erythrocytes has 1,000,000, or one-quarter more carriers of hæmoglobin than one with 4,000,000; hence the latter would need to be richer in hæmoglobin in order to have the same amount in the blood. A high erythrocyte count might be considered of more importance than a relatively high hæmoglobin percentage, since the red corpuscles contain something besides the hæmoglobin.

The following case illustrates the difference, from a surgical standpoint, between uncompensated and compensated anæmia. The patient, Mrs. P., was bed-ridden, emaciated, and anæmic. She had a pyosalpinx with extensive pelvic adhesions, including the appendix. She came out of an operation for these conditions with a pulse of 160, and it ranged for the first week between 110 and 120. She improved steadily until the middle of the second week, but was then attacked with a mild septic diarrhœa, and died at the end of the week. An autopsy showed that the intraperitoneal conditions were normal except for the usual adhesions to the stumps. The cause of death was a small abscess of the thigh produced by a hypodermic injection. Had the patient not had an uncompensated anæmia,—

i.e., an anæmia without the muscular development, blood-pressure, and fat that are necessary for endurance,—she could have survived the development of a small subcutaneous abscess. The compensated cases which I have already referred to bore severe operations well, and would have stood such a one. This case represents a class among whom one must be on the lookout for want of compensation; *viz.*, those with chronic sepsis. The focus may be in the pelvis, in the abdomen, in the mouth, or almost anywhere, and may give no local evidence of its existence.

An anæmia is usually uncompensated in bed-ridden patients with functional diseases. Faulty metabolism, muscular relaxation or atrophy, feeble circulation prevent compensation, and the patient must develop muscular endurance, a good blood-pressure, and freedom from important symptoms before she can be safely subjected to a major operation. This class must not be confounded with those invalid women who keep their beds most of the time, but who are sometimes up, and thus get some exercise and can digest their food quite well. These are usually not very anæmic, or are compensated for their moderate anæmia.

We should also look for uncompensated anæmia among those who are suffering from continuous drain upon their vitality, such as prolonged lactation, deficient sleep, long hours of work, unusual responsibilities and great anxiety, particularly when associated with faulty hygienic influences as regards food, exercise, fresh air, etc. They show their want of compensation in their haggard, listless, or anxious countenances, by occasional attacks of nervousness or despondency, and in forgetfulness. About the only thing they do well is to sleep, although not always that. They are apt to become neurasthenic, and to remain anæmic after the original cause is removed. The Weir Mitchell rest-cure, with the removal of the cause, is the best treatment for such cases.

Patients recovering from serious sickness of any kind do not bear anæmia well. The tone of the muscles and circulation is poor, the bodily functions are feeble, and the amount of fat is usually below normal. Operative measures should be postponed until the anæmia is overcome or until compensation has taken place.

Anæmia from occasional hemorrhages, such as menorrhagia, often comes so gradually that compensation keeps pace with it, and the

powers of endurance are retained; but long-continued slight hemorrhages and frequent moderate hemorrhages do not give opportunity for replacement of the lost blood nor for compensation, hence such cases do not constitute good operative risks.

In operating upon anæmic patients without compensation, particularly those with a low erythrocyte count, we may undertake short operations that involve but little loss of blood, such as a simple ovariectomy without adhesions, an interval appendectomy, a cholecystotomy, etc. Major vaginal operations should, if possible, be avoided, because they are liable to be long operations, attended by a considerable loss of blood. A vaginal hysterectomy for small fibroids may be safer for an ordinary person who can stand a moderate loss of blood than abdominal hysterectomy; but the abdominal hysterectomy is usually safer for the anæmic patient because it is shorter and almost bloodless. Either local or nitrous oxide oxygen anæsthesia is preferable to ether. Chloroform is too depressing to the heart's action for prolonged use.

I need not dwell upon the value of making a blood count in all or nearly all cases that come up for operation, and the necessity that will sometimes arise of taking time to relieve the uncompensated anæmia. All this was well illustrated by the bad results obtained in the last case mentioned. Had I understood the nature and meaning of compensation as I do now, I should not have operated until I had relieved the anæmia or established compensation, and would thus probably have saved my patient.

From what I have said it follows that the mere fact of the presence of a moderate anæmia is of less importance than the way the patient is affected by the anæmia, as determined by a study of the history of the case and the general condition of the patient. Just as one can detect the presence of fever without a thermometer, so one can detect anæmia and depression without a blood count, but a blood count gives us a record and a gauge that in some cases is of the greatest practical value, and makes it much easier to estimate the importance of symptoms and to keep track of the improvement.

THE TREATMENT OF ACUTE PERITONITIS

BY C. P. THOMAS, M.D.

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THE word peritonitis signifies inflammation of the peritoneum, which condition is more a symptom than a disease, therefore, in a description of the treatment of peritonitis we in reality must outline the proper care of the organ, which first becomes pathologic, later extending to the peritoneum, rather than the mere treatment of the symptoms which it produces.

There are, as you know, counting both visceral and parietal, many square feet of peritoneum within an adult abdominal cavity. When infection and inflammation are confined to a small area of this vast membrane, it is termed local or circumscribed peritonitis; when it has spread throughout the entire surface it is called general peritonitis.

There is grave doubt in the minds of many surgeons whether an individual with general peritonitis (accepting the above definition of that condition) ever recovers from the toxæmia so rapidly developing from such a large absorbing surface.

It is impossible, however, before opening the abdomen, always to know from the symptoms presented to just what extent the disease has spread, and we know that patients do recover after operations which show that very extensive areas were inflamed.

The more common micro-organisms present in acute peritonitis and named in their order of frequency are: The streptococcus, colon bacillus, staphylococcus, gonococcus and pneumococcus; and often a mixed infection of two or more of these varieties is to be found.

If we could know early in the disease the exact character of the micro-organisms present, it would aid us materially in making at least a better prognosis, and by the use of the proper vaccine or antitoxin in conjunction with surgery we might even have more numerous recoveries. It is well, however, to remember that peritonitis from a ruptured gangrenous appendix or gall-bladder is

usually due to the streptococcus and colon bacillus; from a perforated gut, to a mixed infection; from stab wounds and puerperal infection to pure streptococcus, staphylococcus, or both. Hæmatogenous peritonitis is usually due to the pneumococcus or tubercle bacillus.

While we cannot tell from the early symptoms with any degree of certainty what the microscopic pathology is in a given case, in most instances we can at least, even before operation, tell where the gross lesion is that started it; and, regardless of its special variety of infection, institute at operation the procedure necessary in most cases, if seen reasonably early in the disease, to insure recovery.

Extensive streptococcic peritonitis often proves fatal, while the gonococcic, staphylococcic, or pneumococcic variety, although destructive to permanent good health, seldom actually causes direct and early death.

That peritonitis in any form is a condition which, in almost every instance, necessitates surgical relief is now generally admitted by the profession; but there is still quite a wide divergence of opinion, even among surgeons, as to the proper time for the operation, also as to the proper after-treatment, one class claiming that all cases are surgical as soon as discovered, others believing that in the severe cases there is a period of several days after the onset of the attack in which it is unsafe to attempt any surgical procedure.

So long as this divergence of opinion exists in the minds of men most experienced in the surgical treatment of the disease, the rest of the profession may expect to be in doubt, and often give the wrong advice.

I can readily see, and will endeavor to explain, why this lack of unanimity exists among surgeons.

Given a skilled and rapid operator with good technic who can quickly open the abdomen and close it after removing the pathologic cause of the inflammation, or after having provided proper drainage of the infected cavity,—whether general or localized,—manipulating just enough to remove the cause and allow free escape of the toxic materials, there is no doubt that he can operate at any stage of the attack, and have not only the greatest number of immediate recoveries, but likewise the best ultimate results, while the slow, clumsy operator who makes long incisions and extensive exposures of intra-peritoneal organs, who hauls sponges and mauls over the tissues, and

uses drainage materials which do not drain, will have both a larger primary death rate and less satisfactory end results in those who do not die.

If this latter class of surgeons would operate very early or very late in the disease, their death rate at least would be less, but their end results, especially in the late cases, would still be unsatisfactory, owing to adhesions. If the general practitioner were to bear these facts in mind when selecting the surgeon he would be wise.

A few years ago one of our leading surgeons wrote an article on the proper time to operate for appendicitis. Unless seen during the first twenty-four hours, he considered it much safer to defer operation for from four to many days after the onset, and at that time a large number of surgeons concurred with him.

The writer on one occasion heard him attempt to explain to a large number of surgeons just how to recognize and outline that opportune time, but he succeeded only in saying that there was just a right time, and that he could tell when it was; he utterly failed to describe it so that any of the rest of us could understand it. This sort of medical knowledge is of little value to either the profession or the people at large.

It is the writer's custom to advise operation at once in all cases of acute peritonitis, at the same time insisting on rapid, clean work, when possible through a short incision, with the right kind and proper placing of drainage tubes in all pus cases. When the appendix is the cause of the inflammation, but it is not ruptured, and there is no general peritonitis, remove it, invert the stump, clean out the serum if any has accumulated in the iliac and deep pelvic fossæ, and close without drainage.

If there is perforation, or escaped pus, or general peritonitis, remove the appendix if it can be done without too much breaking up of adhesions and handling of the intestines, and close with ample drainage to both the above-named fossæ.

If there is a large circumscribed abscess with a loose gangrenous appendix in the centre of it, still remove the appendix, but do not break up the inflammatory wall which separates it from the general cavity. In this variety of cases we can tell whether the abscess is circumscribed by the forceful spurting of the pus from the wound

when it is opened; while in cases in which the barrier is destroyed before operation the pus will merely flow from the wound.

Even in the large abscess cases it is well gently to slip a tube down along the pelvic wall into the cul-de-sac to drain out the serum accumulated there, or what is probably already another abscess. A neglect of this precaution often results in a perforating abscess of the bladder or rectum, another operation, or death.

It must be remembered that gauze alone will not drain pus; rubber tubing either split spirally or perforated will; it should not be withdrawn and replaced from day to day, but should be pulled up and cut off a little each day, and entirely removed when pus ceases to flow.

The writer wishes to go on record as in favor of operating upon every case of appendicitis just as soon as it is diagnosed, if a proper technic can be had, unless the case is already *in extremis*, or there is some other grave constitutional condition which is likely to prove fatal at an early date.

He also believes the best results will be obtained in acute gall-bladder inflammation if the same rule is observed. If the inflammatory process has involved the peritoneum or other surrounding structures, ample drainage must be provided, including the complete cofferdamming of the septic gall-bladder with a large rubber tube surrounding all but the attached portion of it, to prevent contact of the septic material or diseased organ with any other structures.

If there is gangrene of any portion of the gall-bladder, that part must, of course, be removed, and it may be best to remove the entire sac. Delay in such cases can only mean more primary deaths, and also a larger number of imperfect recoveries from numerous intra-peritoneal adhesions.

When the inflammatory pelvic troubles of women have reached the pus stage, they are likewise made worse by waiting. The sooner the pus-containing organ, whether tube or ovary, is removed the better it will be for the patient. If the infection is limited to some deep pelvic glands, nothing can be gained by waiting for them to break down, or if the pus is free in the pelvis owing to leakage from any of the septic cavities of that region delay will certainly not improve matters.

In nearly all of these conditions drainage is again indicated

after the removal of the pathologic cause, and should be provided for by properly placing a spirally-split rubber tube which is brought out through a stab wound, well away from the long incision to avert its infection and consequent hernia, but never through the vagina. While it is impossible to drain away all the septic material by any method, yet, if rightly done, enough may be removed to enable the patient to dispose of the rest of it.

Vaginal drainage is unclean, unsurgical, unnecessary, very painful, and, where a rubber tube is used, often leads to intestinal perforation by pressure; while, as before stated, gauze will not drain much pus from here or elsewhere.

The other acute inflammatory conditions due to trauma, strangulation, or perforation are certainly best treated by early operation and drainage. After removing the cause of the peritonitis, the intestines if greatly distended can be relieved by puncture before closing the abdomen.

While early operations with proper drainage are all-important in the treatment of peritonitis, a number of other valuable methods may also be used, such as posture, Murphy's proctoclysis, lavage, ice-bags to the abdominal wall, etc.

For the first thirty-six hours after the operation the patient should be kept in that position which will insure the best gravity drainage in the direction of the wound, intra-abdominal pressure being allowed to do the rest. It should also be remembered that the lower part of the abdomen is more resistant to infection than the upper portion.

Murphy's proctoclysis should be used only in such quantities as can be absorbed, more than this doing harm. By practical experience I have reached the conclusion that ordinary tap-water should be used in proctoclysis rather than salines. The salt increases the thirst, is not absorbed any faster than the tap-water, and in large quantities is sometimes poisonous. Ice-bags should be placed against the entire abdominal wall except for a small area over and around the wound which should be covered with dressings, one thin layer of gauze only being interposed between the bag and the skin. This very materially allays pain, and, I think, probably actually lessens inflammation.

When vomiting is present, lavage is given often enough to keep the stomach empty, and there should be no stomach feeding while

nausea and gas exist. If the pain is endurable, narcotics are not used, and, if at all, only the smallest quantity is given the first night. Stimulation should be begun early and continued until danger is past. The early administration of cathartics is not advisable, but the colon is kept empty by enemata. When nausea and vomiting have disappeared, active cathartics may be given, but before that time they do more harm than good.

The administration of vaccines and antitoxins has its field of usefulness, but must be based in each case, as heretofore suggested, upon definite microscopic findings.

The writer has followed the above course in over two thousand cases of acute intraperitoneal inflammatory conditions, and has not only had a very low death rate but a large percentage of good end results, and if for any reason he has been compelled to change this procedure he has almost invariably regretted it.

In conclusion I would advise the earliest possible operative treatment of all cases of acute peritonitis, not *in extremis* and when in the hands of an active, rapid operator, remembering that in appendicitis the only way to insure that another attack will not occur is either to allow this one to kill the patient or else remove the appendix, and about the same rule will apply to gall-bladder and other acute intraperitoneal inflammations. While I believe the slow, bungling surgeon might do better to select a special time in which to operate, I will frankly admit that I know of no method of estimating exactly that proper time, and that many will die while waiting for it. Correct drainage, then, with the other nonoperative methods above outlined, will reduce the death rate in this condition to about one per cent., whereas it was nearly eighty per cent. under the old "let-alone" treatment.

SUPPURATIVE PYLEPHLEBITIS *

BY CHARLES R. ROBINS, M.D.

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It is stated by Deaver, on the authority of the researches of Pelligrini, D. F. Jones, A. K. Gerster, and on his own series of cases, that suppurative pylephlebitis or hepatic abscess occurs in from one to two per cent. of all cases of appendicitis. Judging by my own records, this percentage appears to be very high. My first case of suppurative pylephlebitis occurred in 1911, and this case presented such typical symptoms and was at the same time so remarkable that a somewhat detailed report may be of interest.

(Private records) Case No. 16-531 was seen by me at his home in the country on August 30, 1911. He was 36 years old, white, single. Five days previously he had been taken with a violent pain in the abdomen, worse in the epigastrium, and with vomiting. On the next day he had had a chill and his temperature rose to 103.5° and the pain in his abdomen continued. He had been treated by starvation, elevation of head of bed, and rectal saline, and had become more comfortable, but continued to have a bad feeling in epigastrium.

On examination he was found to be a very stout man with a large collection of fat on the abdomen. His abdomen was distended throughout, and on the right side there was considerable resistance and near the anterior superior spine a hard mass of inflammatory exudate could be made out. A diagnosis of appendicular abscess with either gangrene or rupture of appendix was made and the patient taken to the hospital next morning. On admission his temperature was 99.8° , pulse 96, and respiration 24. The following day he was

* Read before the Southern Surgical and Gynecological Association, December, 1912.

operated through a McBurney incision and the omentum found adherent over the mass, with no adhesions to anterior abdominal wall. The abdomen was walled off with gauze sheets and adhesions of omentum released, revealing an abscess cavity containing about two ounces of foul black pus, with the tip of a gangrenous appendix projecting into it. The pus was mopped out, and examination of the appendix showed that its base was postcæcal and very densely adherent. It was determined that its complete removal would be hazardous, so the gangrenous portions only were removed. The abscess cavity was drained with rubber tube and gauze and the wound partially closed. After the operation the patient was fairly comfortable, but his temperature rose to 102° as the daily maximum, with slight remissions until seven days after the operation he had a chill and temperature went to 103° . A leucocyte determination showed a total of 18,000, polynuclears 72 per cent. He then had one chill daily for three days, the temperature beginning to show marked remissions, and on the ninth day following the primary operation he was again anæsthetized and an exploration made of the abscess cavity with the finger, and a small pocket of pus and a fecal concretion were found behind the cæcum. This cavity was drained by a counter-incision in the flank and a rubber tube carried from the original wound to the counter-opening. Following this the patient had two chills the same day, but the next day his temperature declined to normal. On this day his total leucocytes were 18,800, polynuclears 88 per cent. On the day following he had another chill and was given an injection of coli bacterins, 2,500,000, which was repeated on the following day.

The clinical picture at this time was as follows: He complained constantly of abdominal pain, which was most intense to the right and above his umbilicus, and at this point he was very tender. He also had griping pains through the abdomen that would come on in spells. No masses could be made out in the abdomen. His liver was somewhat enlarged and spleen was very much enlarged and could be easily palpated. He did not suffer from nausea and was able to take nourishment fairly well, but would often vomit when he had a chill. Defecation was rather regular, and he would have from one to three movements a day, which were often black in color. There was some cough, which was at times annoying. Careful physical

examinations of the chest were made by Dr. Manfred Call and a slight dulness was made out in the lower posterior aspect of the right chest, but exploratory puncture of this area and of the liver was negative and no abscess of the liver could be made out. A diagnosis of suppurative pylephlebitis was made and a gloomy prognosis was given. I then began the administration of Van Cott's formula of vaccines, and a careful leucocyte determination was made, at first each day and finally at frequent intervals. In a period of twenty days he had 41 chills, and during this period two doses of 2,500,000 coli bacterins and six doses of one cubic centimetre of Van Cott's formula of vaccines were given. The chills would last from a few minutes to 35 minutes and were very violent, and would be followed with drenching sweats which necessitated changing the bed clothes. The excursions of temperature were very marked, occasionally extending over as much as eleven degrees, from 105° to 94°. His leucocyte count remained fairly well balanced. His chills then became less frequent, occurring at intervals of from one to four days, but his temperature remained high and he continued to suffer with violent pain to the right of and above the umbilicus. At the same time no mass could be made out. Finally, on October 4, 43 days after the operation, a right rectus exploration was made. There was a considerable amount of slightly red-tinged fluid in the abdomen, the liver was somewhat enlarged, but presented no evidence of abscess and was not adherent at any point. The gall-bladder was normal. The veins of the mesentery were enormously enlarged, especially those draining the appendiceal and cæcal region. No abscess could be made out through this incision. The incision in the flank was enlarged and the entire space behind the ascending colon as far as the liver was opened by exploring with the finger. There was a great flow of black blood from the enlarged veins, but no abscess was found. All of the wounds were drained. After this Van Cott's vaccines were continued. There were seven chills with violent excursions, and then for a period of nine days there were no chills and the temperature reduced until the daily excursions were from normal to 102°. His abdomen, which for some time had been distended with fluid, became even more distended, and on several occasions it broke through at one of the points of drainage and discharged first some pus and then a large amount of clear serum, which would continue to

flow for some days. He continued in this way, with improvements and relapses in his condition, until November 29, 99 days after his original operation, when he entered into a period where he had no chills and his temperature gradually subsided, until by December 23 the highest temperature for the day would be 100° , but during this time his abdomen became more and more distended. I was of the opinion that the veins had become thrombosed and the infection overcome, and was contemplating some operation to overcome the ascites when he suddenly became worse, and on December 31 I opened his abdomen in two places and found that the fluid had become purulent. He gradually sank and died on January 13, after an illness of 152 days. During this time he had had 75 chills. An autopsy was refused and was not insisted upon.

The severity of the case, its extreme prolongation, and the apparent recovery at one time make it most interesting. As to what effect was had from the administration of Van Cott's vaccine I have not been able to definitely determine. In all 28 doses were given. It seemed to me that it caused improvement. When first commenced the patient was in a very toxic condition and was delirious at times, but in a short while his mind became clear and remained so, notwithstanding the severity of his symptoms, until his last relapse. I could not see that there was any particular effect on the leucocyte count, except that it remained fairly well balanced. In view of the fact that this malady is usually rapidly fatal and that no plan of treatment has yet effected a cure, I think that treatment along this line probably offers the only hope, and the apparent success at one time was encouraging.

In reviewing the literature in connection with this case I was somewhat surprised to find that only very slight references have been made to this condition in the journals. I found fairly complete descriptions in Deaver's "Appendicitis"; in the section on Appendicitis by McCosh, in the "American Practice of Surgery," and in the latest edition of Strumpell, but the best description I found was that by Rolleston on "Diseases of the Liver."

The most frequent cause is suppurative appendicitis, although it may be caused by other gastro-intestinal lesions, of which gall-stones is the most important. The inflammation commences in the appendiceal vein and extends to the superior mesenteric, thence to the

portal vein and the radicals in the liver. The vessel walls become swollen and softened and sometimes break down, and the vein contains a mixture of pus, blood, and clots. The extent of the vein involved varies very greatly. Multiple abscesses of the liver naturally develop with great frequency, but cases have occurred in which the liver has not been affected.

The clinical picture presented is, first, of the primary disease, usually appendicitis, and, secondly, the development of the pyæmic state. Rigors are usually present at first, and when these follow an appendicitis in which the abscess has been thoroughly drained it is highly suggestive. The liver is usually uniformly enlarged and accompanied by pain and tenderness in the hepatic region. The spleen is usually enlarged, due to the toxic state.

As to the question of diagnosis, it must rest, first, on the causative disease; second, on the development of the pyæmic state; and, lastly, on the exclusion of other causes for the symptoms presented.

Medicolegal

RAPE IN CHILDREN AND IN YOUNG GIRLS *

BASED ON THE PERSONAL INVESTIGATION OF SEVERAL HUNDRED CASES OF RAPE AND
OF OVER FOURTEEN THOUSAND VAGINAL EXAMINATIONS

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PART II.

THE DIAGNOSIS OF PREGNANCY

A NUMBER of patients presented to me for examination following rape were found to be pregnant, and I shall briefly discuss the diagnosis in the early part of pregnancy.

Within ten weeks from conception the diagnosis of pregnancy is often very difficult on account of other conditions which may give rise to the same or similar symptoms. It is surprising how often this possibility is overlooked; the oversight, in many cases, being due not so much to any neglect on the part of the examiner as to the fact that the patient presents typical symptoms, or, again, that it is not suspected. Nevertheless, there are cases in which a careful bimanual examination gives strong evidence that the girl is pregnant, though a less thorough examination will tell us nothing. The appearance of suggestive subjective signs of pregnancy in the patient will probably lead us to believe that the objective symptoms would be as distinctive, and we are therefore surprised how indistinct or few are the conditions which indicate that pregnancy has occurred. The reverse of this statement is equally true, so we should endeavor to combine both subjective and objective symptoms in making up our minds as to the conditions present. We may form the conclusion that a patient with amenorrhœa, nausea, breast pains, and frequent micturition is pregnant, but when we examine her and do not find

* Continued from p. 267, vol. ii, 23d series of the INTERNATIONAL CLINICS.

vaginal discoloration, soft cervix, and enlarged uterus our opinion may be reversed.

Menstruation may never have been established. It may have been suppressed from other causes than pregnancy, or it may be retained within the uterine cavity or vagina, as from an imperforate hymen. Fear of impregnation in the single, change of climate, getting the feet wet just previous to the expected flow, and various constitutional diseases, especially tuberculosis, may cause amenorrhœa. A point worth remembering is that amenorrhœa arising from any cause other than pregnancy usually shows itself in the patient's general condition. I call your attention to this fact: young girls are frequently found to be pregnant before menstruation has been established. The mammary signs of pregnancy are not constant and are often misleading. In young girls the breasts frequently tingle and burn for a few days previous to menstruation's onset; they also increase in size and become tender to pressure. In pregnancy the nipple is usually more prominent and may be puffy. The superficial veins may be seen quite plainly in some cases. Increased frequency in micturition, combined with amenorrhœa, in the absence of any bladder trouble, are probably the two most important subjective symptoms. I am aware that a nervous patient, who has suppression of the menstrual flow, may pass water more frequently on account of nervousness, but when this condition persists for several weeks it is a symptom of considerable value.

Nausea and vomiting vary much as to time and severity; some have persistent vomiting early, which is severe enough at times to suggest some gastric pathology or so critical as to imperil the life of the patient. Others never have the slightest reflex disturbance throughout pregnancy. The nausea of pregnancy is usually of sudden onset, appearing when first assuming the upright position in the morning, or when awakening; is apt to be of short duration and accompanied by a feeling of dizziness. There are some who are nauseated only before retiring.

The most important and reliable symptom, one which may be appreciated quite early, is to be found in the change of shape in the uterus. In the virgin the shape of the healthy uterus is pyriform, but when pregnancy occurs the fundus rapidly enlarges and changes in form. The cervix, not keeping company with this growth, gives

to the sense of touch that of a spheroidal body on a cylinder. In other words, the uterus, which is not the seat of an ovum, feels like a funnel, the cervix broadening gradually into a broader fundus, whereas in the pregnant uterus the finger appreciates the flattening of the lower uterine segment. This is felt on all sides, but much more distinctly laterally, as the width is at times twice that of the anterior posterior thickness. This is a most reliable sign and can be felt as early as the fifth week. We must remember that this change can only be appreciated in the absence of uterine contractions, as they alter this condition by hardening the uterine body. Knowing that our bimanual examination will often cause contraction, repeated efforts are necessary to find the uterus at rest. Possibly a collection of fluid within the uterine cavity or a small cystic fibroid might cause this condition, but the history and symptoms would be quite different from those of pregnancy.

Softening of the lower uterine segment, Hagar's sign, is at times misleading and not always felt. Softening may be present in endometritis and also in an infra-uterine collection of fluid. When the finger can appreciate this change, and there are associated with it other signs of pregnancy, it will be found of the greatest value after the second month. The softening of the cervix is not constant and can rarely be appreciated before the eighth week, and may not occur at all on account of an old laceration tissue, and can be caused by metritis in the non-gravid uterus. Many say that the bluish discoloration of the vaginal mucous membrane is of little or no value as a sign of pregnancy. I regard this sign as of considerable value. The change is seen best just posterior to the urethra, and is of a dull lead color. I have noticed this as early as the fifth week. Frequently in the second month the mucous membrane is of a deep purple. It is claimed that a fibroid or any pelvic congestion can cause this discoloration. I have rarely found this to be true, and when it does occur the color is not so limited in extent and is of a lighter blue. This symptom in itself becomes of value only when taken in conjunction with other symptoms of pregnancy. In these cases I have so often felt a softened, almost emphysematous, condition of an antiflexed uterus, making it difficult to accurately outline the uterine body, that I look upon it as a most distinctive and important objective symptom. Placing the finger on the cervix and

allowing it to glide up the anterior uterine wall, it comes in contact with a sponge-like tissue, which feels puffy; this, combined with increased breadth of the uterine body, makes the diagnosis of pregnancy about certain. As stated, this is only felt between contractions. Two other important symptoms are a cervix lower than normal, and increase in weight of the uterus. In the healthy non-pregnant uterus that organ can be moved in all directions with the greatest ease, imparting to the sense of touch a feeling of buoyancy, but in the second month of pregnancy the increased weight and sluggishness of movement are appreciable.

When called as a witness in a rape case where pregnancy has occurred it is a most unwise procedure to swear that the girl is pregnant unless you have distinctly heard the foetal heart sounds, palpated the foetus through the uterine wall, or have secured a skiagraph of the foetus *in situ*. The foetal heart-beats are seldom heard until after the twelfth week, and, of course, will be absent if the foetus has perished. In highly nervous girls, or in those suffering from some form of cardiac disease, the maternal heart-beat may be as rapid as that of the foetus. In many cases when I felt convinced that the girl was pregnant I have been asked by the Court if pregnancy was present. My answer has always been that, from the history and symptoms obtained after a careful examination, I believed the patient was pregnant at the time of my examination, but was unwilling to swear to this unless I had heard the foetal heart sounds or palpated the foetus.

Within the past eighteen months three patients were presented to me for examination. They had similar histories of amenorrhœa, breast pains, and abdominal enlargement. Each was convinced she was pregnant and, being unmarried, was desirous of securing warrants for the alleged guilty parties. The examination disclosed the interesting facts that all had abdominal cicatrices, and further investigation showed that two had undergone double ovariectomy and the third abdominal hysterectomy.

THE EXAMINATION OF THE ACCUSED

In any examination of the defendant, in a case of alleged rape, there are several points to be carefully considered. We must take

account of the general build, strength, and size of the man in relation to those of the girl. His body should be examined thoroughly for evidence of the girl's struggles against the assault, as to scratches, bruises, teeth-marks, etc. Inquiry should be made as to his ever having had any operation on his genital organs, and also if any venereal infection exists or has existed, and in certain cases the serum tests for these diseases should be made. Although they will generally answer in the affirmative, inquiry should be made as to the willingness of the victim. Also there should be procured a definite statement as to whether the man admits or denies the charge, and as to whether he was under the influence of liquor at the time. This latter is very important, as in many cases the man will admit the assault and will state in justification that he was intoxicated. As is well known, intoxication is not recognized by the law as an excuse. Examine carefully for any venereal infection, noting the size of the genital organs, and pay particular attention as to there being a uniform layer of smegma present; the existence of the smegma layer in itself precludes the probability of complete sexual intercourse having taken place within a short period. Is the man crippled in any way which would make the act particularly difficult? If he is married, is his wife living, and does he live happily with her, also has he any children? His mental condition must be carefully noted, especially as to his being feeble-minded or irresponsible. Make notes of any abnormal conditions found, as such knowledge will be useful when called as a witness in court. Compare the statements of the girl with those of the man, as frequently discrepancies are found that will aid greatly in arriving at a conclusion which appeals to our common-sense and reason. A man may admit having the girl in his room and even admit to the fact that he had spent the night in the same bed with her, and yet may deny any wrongdoing, perhaps actually saying that the girl tried to tempt him to perform sexual intercourse. This statement has been made to me a number of times. Each of us, in such cases, must arrive at his own conclusion regarding the probability that the man had not fallen from virtue. The excuse of extreme intoxication, as I have just said, is one often heard: "I did not know what I was doing." This excuse can be easily answered. A man so beastly drunk as not to realize,

even to the least extent, the horror of his crime can hardly be in physical condition to make the act possible. Sometimes a girl will give the excuse that she was asleep when the assault took place. Although there are cases cited in the endeavor to prove that this is possible in females accustomed to sexual intercourse, it can be stated that sexual intercourse with a virgin who is physically and mentally normal is impossible without her knowledge while she is sleeping.

It is most essential that the exact age of the defendant be determined, as the law states "that a male of fourteen years of age is presumed to be able to commit a rape." There are certain exceptions to this rule, but where the defendant approaches this age it is important that the exact date of his birth be determined.

THE EXAMINATION FOR VENEREAL DISEASE

Many of the defendants are infected with venereal disease, and in some instances transmit disease to the victim, hence it is important that we briefly discuss these conditions. A purulent discharge will not arise within twenty-four hours following the attempt to rape, and venereal sores do not appear suddenly. This may sound rather odd and unnecessary, but it will aid us in many cases where such infections have been attributed to the accused.

I have seen many cases infected with gonorrhœa and syphilis, the latter with well-marked secondary eruptions, who, when examined within forty-eight hours after the attack, explained that they were free from any disease previous to the above assault. In some instances I have been fortunate enough to have made an examination of the accused, usually finding him free from any venereal infection.

The important points to bear in mind are that the victim must not only be suffering from the same infection as the man, but the period of incubation must be within reasonable bounds in the several infections. Patients present themselves with the explanation that they had intercourse with the accused "yesterday," and with no one else at any time, and you find a typical chancre or a virulent discharge swarming with gonococci, while the man shows no signs of present or past infection. Where we find a well-advanced case of syphilis in the girl, and the beginning of a syphilitic sore on the accused, it is hardly fair to say the man was the infecting agent.

I have been put through very rigorous investigations by presiding judges regarding these infections, and it is always well, when appearing in court, to have considerable knowledge as to the history, symptoms, duration, incubation period, and ultimate effect on your patient of the infection in question. You may be questioned regarding the characteristics and differences of the various discharges, eruptions, and sores. A prominent jurist, during a trial for rape, asked me the following: "Where did the gonococcus originate? If it never existed normally in the urethra, how could it exist pathologically? In other words, did it ever exist normally in the urethra, and if not, where did it come from?"

Cases of syphilitic infection very rarely, so far as my knowledge goes, occur within ten days following the exposure. Syphilis has a fairly definite period of incubation of from two to four, or more, weeks, averaging about three weeks. In gonorrhœa and chancreoid the interval varies considerably. The former may appear in from a few hours to two weeks after contact, and in the majority of instances makes its appearance within the first week. A chancreoid sore has no period of incubation. It usually begins as a small red spot, in forty-eight hours becomes converted into a papule, and in two or three days into a pustule with abundant pus. Chancreoid infection is often multiple, is accompanied by pain and itching, and the sore has a punched-out appearance, with a rough, worm-eaten surface.

The true chancre begins as an erosion, an ulcer, or a papule which ulcerates. It is usually single and superficial and has a smooth, glazed surface. It is often found covered with a grayish or yellowish false membrane, which, when disturbed, shows a bleeding area, while the parchment-like induration is almost invariably present. This induration is due to sclerosis of the minute blood-vessels. The sore is often painless and is accompanied by bubo. The bubo is formed of multiple glands and is seldom sensitive.

It is fairly safe to state that a discharge which makes its appearance in from three to eight days following the assault will be found to contain gonococci, and the fact must be established that the girl did not have said discharge previous to the attack. The female may have contracted gonorrhœa from some other person than the defendant, or the defendant may have been infected by the girl her-

self. Again, both may have been suffering from this disease, each having contracted it from outside sources. We must always bear in mind the prevalence of gonorrhœa among young female children of the poorer classes. I am credibly informed that in hospitals for children nearly 25 per cent. of the young female infants are found to be infected with gonorrhœa. Smears are taken of each case applying for admission, and, in spite of every precaution, it is a very difficult matter to prevent the extension of the disease to other children in the same ward. I believe the reason for this is the fact that the infecting period has begun *before the appearance of the discharge*. When this fact is known the transmission to others is usually preventable.

Finally recall the curious epidemic of vulvitis recorded by Weil and Bargon at the Charité Hospital in Lyons in 1891, where a thermometer played the rôle of the transmitting agent; this, too, was gonorrhœal.

The statement ascribed to Dr. Hutchinson, that probably not once in one hundred acts of coitus with a syphilitic patient is a chancre contracted, appears to me to be rather liberal. In any event, it does not, of course, include the cases under discussion, in which the delicate, freshly-lacerated tissue is likely to become infected.

Being capable of infection, a mucous membrane, when brought in contact with a secretion containing gonococci, will almost without question breed a gonorrhœal infection; and, likewise, a secretion, whatever its source may be, which is free from gonococci cannot under any circumstance, of itself, give rise to a gonorrhœal infection. When the gonococcus is found in a discharge, that discharge is of a gonorrhœal origin. No matter where or in whom found, there is absolutely no question as to this fact. We know it is true that without the gonococcus there is no gonorrhœa, and, conversely, without gonorrhœa there is no gonococcus. It must be understood that it is possible for the man to deposit gonorrhœal pus within the vagina, and a smear from the girl taken directly after the assault may show the presence of the gonococcus without her having gonorrhœa.

No doubt you have noticed that many of the defendants who are infected with gonorrhœa are Italians. This is partly attributable to the belief, strong with them, that such a discharge will be cured by having sexual intercourse with a virgin. To some extent

the colored race are imbued with this unfortunate superstition. Apropos of this, the following case is of interest. An Italian girl of fourteen years was presented to me for examination twelve days following the alleged assault. She claimed to have been raped by one of her countrymen, aged twenty-one, who was engaged to another girl. Ten days previous to the time set for the wedding he discovered a discharge from his urethra. Five days later he attacked the defendant and infected her with gonorrhœa, as no doubt he did his bride a few days later. In fact, this Old World superstition is common in India and Europe, and is becoming more widespread in America, and there are reasons to believe that those holding this dangerous dogma that the younger the virgin the surer the cure.

Koplic mentions a case of two boys, aged five and nine respectively, who contracted gonorrhœa by sexual intercourse with a girl of seven years.

From a medicolegal point of view it must be carefully considered that the finding of the gonococcus in the vaginal smear of girls is of importance in certain cases. I have in mind several cases where the assault was claimed to have taken place within twenty-four hours previous to my examination, and the physical findings, on examination of the hymen, appeared to bear out this statement.

Now, supposing there is found a vaginal discharge which on microscopical examination shows abundant gonococci. Here we are confronted with three questions: First, that the girl was infected with gonorrhœa previous to the assault; secondly, she was infected at the time of the assault; thirdly, that the smears obtained from the vagina of the girl were directly contaminated by the discharge from the man's urethra. In other words, it was the man's pus-cells which contained the gonococcus. This may be a fact, but it would be unjustifiable to even suggest this with the justification of your finding the gonococcus at this early period.

This brings us to the question as to whether the defendant was suffering from gonorrhœal disease at the time of the assault. This does not mean that he necessarily need have any urethral discharge at that time. Finding the absence of urethral discharge, enlarged testicle, epididymitis, swollen glands, and stricture strongly points to the fact that he was not the infecting agent. Even the finding of a gonorrhœal discharge in the man does not warrant your evidence

that such infection arose from him, as the origin of such infection is so widespread that the wise medical man is tardy in expressing any definite opinion as to its source.

I would strongly urge a second examination in all cases where a vaginal discharge is found to be present. In many cases I have been able to find the gonococcus in subsequent examinations which were not found in the first smears.

THE MICROSCOPICAL EXAMINATION OF PUS SMEARS

My examination for the gonococcus proceeds as follows: If the patient has a discharge from the urethra (in the female I invariably take smears from the vagina in all instances) or gives me reason to suspect gonorrhœal infection of the sexual organs, I take four smears and dry them in the hot-air current over a Bunsen burner or alcohol lamp.

One of these smears is now stained with several drops of methylene blue. The stain is then allowed to stand for three or four minutes, and it is then washed with water and examined with a 1/12 oil immersion lens and a one-inch eyepiece. I go over as much as possible of the smear, carefully inspecting for the intercellular diplococci, which are found in their characteristic grouping. Failing to detect any of these bodies, I stain a second slide similarly to the first, and again carefully repeat the examination, when, if still unable to detect any suspicious cocci, I feel safe in stating that there are no gonococci present. I find it wise, however, to stain two other slides, and invariably, when possible to do so, obtain further smears to work upon. Finding the intercellular diplococci, I now take another slide and stain by Gram's method, by which practically all intercellular diplococci which are found in the urethra or in a vaginal discharge other than the gonococcus will stain violet, while the gonococcus is destained red. It follows that if the cocci found in a smear prepared in the ordinary way disappear following the application of Gram's fluid and alcohol washing, they can be no other than gonococci.* By using a water instead of an oil immersion we may restrain with fuchsin, causing the gonococcus again to become visible.

The following materials are required for making this test: (1) A solution of gentian-violet in aniline water; (2) Gram's solution; (3) 95 per cent. alcohol; (4) dilute solution of fuchsin; (5) distilled water. The first solution should be made fresh, as after a few weeks it becomes useless. To a test-tube half full of distilled water add a few drops of aniline oil and then add 4 Cc. of an alcoholic solution of gentian-violet to 21 Cc. of the aniline solution and again shake.

We can now proceed in the following manner: (1) Stain with the aniline solution of gentian-violet for five minutes; (2) wash with distilled water; (3)

*While practically it is not observed, yet there is no reason why it might not be possible for either the *Micrococcus catarrhalis* or the diplococcus of epidemic meningitis to occur in a discharge from the genital tract. Both these organisms look the same tint and are morphologically undistinguishable from the gonococcus.

add Gram's solution, allow to remain for two or three minutes; (4) wash thoroughly with 96 per cent. alcohol until all purple color in the washings disappears; (5) add fuchsin solution until the smear shows a decided pink; (6) dry and examine.

By this method the gonococcus stains a light red, while organisms which are positive by Gram's method stain a deep violet, almost black.

In medicolegal cases, where there is doubt, always resort to cultivation before expressing a positive opinion as to the organism being the gonococcus.

It is quite permissible for the examining physician to procure a signed statement from the accused so long as he is willing to be examined, and to voluntarily place his signature to his statement. This should always be made in the presence of at least one witness, and the accused should always be informed that anything he may say or sign may be used against him in court. In one of my cases referred to I found the defendant (see the case of the Italian) was suffering from gonorrhœa and had without a doubt infected the girl. The man's attorney objected to my testifying to any examination of his client, and was upheld by the Court. The prosecuting attorney tried in every way to have this admitted as part of his evidence, but in spite of a talk at the side bar I was not allowed to testify as to my findings in the man. I may say, however, that he was found guilty of the rape. As a rule, the physician is allowed to testify as to his examination of the defendant. In the courts of Philadelphia I have done so many times. Of course, during the said examination there must be no coercion or force used in any manner; you should be able to satisfy the defendant's attorney that the man was willing to undergo the examination and sign his statement.

THE FREQUENCY OF THE COMMONWEALTH'S WEAKNESS IN RAPE PROSECUTIONS

From the standpoint of the Commonwealth, the law finds itself at a disadvantage in trying a man for rape on account of the few witnesses which it is ever able to present. A crime of this kind is one perpetrated in secret, and only in very exceptional cases is there a witness who was present and is able to corroborate the victim's story. When such a witness is presented it is usually a girl friend whose testimony is, as a rule, quite unreliable, as she too often was, or is afraid she will be, charged with being a co-partner in the act.

The girl, her parents (in the vast majority of cases it is the

mother), perhaps an agent of a society, the officer who made the arrest, perhaps the girl's spiritual adviser, and the examining surgeon compose, usually, the body of witnesses called by the prosecution. As a rule, the parent and the victim make poor witnesses. The testimony of the former is open to attack by the defending attorney as being biased and influenced by paternal love; while the girl herself, I am sorry to say, is apt to give the weakest testimony of all. When she is brought to you for examination it is probably the first time she has ever been quizzed regarding her sexual life, and it is only under the most gentle persuasion and encouragement that the physician is able to obtain what may be accepted as a statement approaching the truth. The young girl who has not been tutored as to matters sexual is most likely to give the medical man a true history of the assault when alone, with only one witness beside the examiner, and when questioned in a quiet, dispassionate manner.

On the witness stand, before hundreds of curious, morbid people, she is questioned by two quick-spoken, ferreting, non-sympathetic men with diametrically opposite objects. She naturally fails to do herself justice. The District Attorney's representative asks questions that are deep in meaning but of which the witness knows little or nothing. When she is taken in hand by the defending attorney, who asks the same questions a little differently, her "Yes" and "No" often absolutely contradict her former replies. Such apparent contradictions inevitably impress the jury unfavorably.

The law does try, and try earnestly, to correct such discrepancies, but its relation to a witness has been, and probably always will be, far different from that of a physician to his patient. I am convinced that it is not in keeping with modern progress to have a charge of rape on a young girl tried in open court. It is only necessary to be present when such a case is called to see the attention which is immediately manifested, especially among the women and children in the court-room. It is not a nice thing to hear some innocent, frightened child tell a pitiful story of her destroyed maidenhood. The child is in no way spared by the lawyers, and the prosecuting attorney or the defendant's counsel compels her to go over her story, not only in detail, but in many instances in the least pleasing language. I have often seen a child become so confused

that she would answer either "Yes" or "No" to each question without having the slightest idea of what the question was or its meaning.

In some of the Magistrates' courts in Philadelphia it is the custom to hear all sodomy cases in private. I may add that this custom brings much disappointment to the curious onlookers. This is an excellent ruling, and it certainly should be carried out in all cases of alleged statutory rape. There are reasons to believe that in a private trial more satisfactory evidence could be obtained, especially from the victim. I have been impressed in some of these trials for rape that the prosecuting attorney seldom asks the physician his conversation with the girl, yet in many instances the testimony which a physician is able to give is of the greatest value and importance, for the reasons of its being obtained under favorable circumstances and conditions.⁵

When appearing as a witness in court I would suggest a few points which may be found useful. Do not confuse the jury by minute evidence. Sum up your evidence of many facts in as few words as possible. Always keep in mind your limits of personal error in all your examinations. The Court requires the essential truth and facts and not personal opinions; bear this closely in mind, unless a personal opinion of your own is asked. In all your examinations concentration and quiet will aid greatly at arriving at a definite conclusion as to facts. The blunt demand of an attorney for the answer "Yes" or "No" may be the only thing justifiable, but is most unsatisfactory to one's self-esteem and judgment. Your observation only is required as a matter of evidence, and that observation must be told in the ordinary way which the jury will understand, and not what the Court should naturally understand. Absolutely confine your opinions to first-hand observation and per-

⁵ From a legal standpoint the following may be taken as an answer to this question. Such evidence would be mere hearsay, and the law does not permit one witness to state what another witness told him, unless a declaration against interest and the person is on trial. If the girl exculpated the defendant, the doctor could testify to this, because it would discredit the prosecutor, but anything the prosecutrix might say to the doctor during the examination against the defendant would be inadmissible, because she could say anything. The law requires the best evidence of facts, and, of course, the best evidence of what the girl said would be her own statement on the witness stand.

sonal examination. Before appearing as a witness in court, cross-question yourself more thoroughly than any attorney is capable of doing. Keep in mind that you know far more, as to medical facts, than the attorney, but that legally he will endeavor to prove to the jury otherwise.

I have found the following chart of service, as it gives a permanent record in a rather concise way. A rubber stamp gives the cut on which we may mark the location of any lacerations, sores, etc.

PHYSICIAN'S REPORT USED IN INVESTIGATING CASES OF ALLEGED RAPE

1. Date and place of examination. Hour.
2. Persons present during your examination.
3. If patient has been examined by anyone previous to your examination, give name of examiner, with date and place, also if he introduced a speculum or made a digital vaginal examination.

Examination of Patient

- | | | |
|-------------------|------------------|-----------------------------|
| 4. Name. | 7. Social state. | 10. Occupation. |
| 5. Residence. | 8. Nativity. | 11. Parents living or dead. |
| 6. Date of birth. | 9. Color. | 12. Name of accused. |
13. Full statement of patient or guardian, giving date, place, and hour, using the exact wording as expressed by the narrator.
 14. Was same thing ever attempted by anyone else? If so, give names, dates, and hour.
 15. Is patient feeble-minded or intelligent?
 16. Do her answers appear truthful?
 17. Is accused any relation to patient?
 18. Did she struggle or cry out?
 19. Did the accused remove any of his or your clothing, or tear your clothing?
 20. Did he hurt you and did you bleed?
 21. Are you sure he was inside you or just between your legs?
 22. Whom did you tell, and how soon after the assault?

Physical Examination of Patient

23. Is she robust?
24. Does she show any signs of constitutional disease?
25. Does patient present any bruises, sores, inflammation, blood or seminal stains, or nail or finger marks on legs, arms, neck, etc.?
26. Are there any signs of mutilation by any instrument or evidence of attempted sodomy?
27. Date of first menstruation and of last menses.
28. Description of any vaginal discharge.
29. If the hymen is lacerated, state if it is single or multiple, recent or old.

30. Did you make a digital vaginal examination, or introduce a speculum?
31. Did you find any signs of pregnancy?
32. How many smears did you take, and were there any gonococci present?

Examination of the Accused

- | | | |
|----------------|-------------------|------------------------|
| 33. Name. | 36. Color. | 40. Living with wife? |
| 34. Residence. | 37. Occupation. | 41. How many children? |
| 35. Age. | 38. Nativity. | 42. Is he a cripple? |
| | 39. Social state. | |
-
43. Is he robust or feeble-minded?
 44. Does he show any signs of constitutional disease?
 45. Are there present any signs of syphilis, urethral discharge, bubo, enlarged testicle, or sores?
 46. Did you find any scratches, bites, bruises, blood-stains, or marks of any kind?
 47. How many smears taken, and result?
 48. Does the accused admit or deny the attempt to rape, and was he under the influence of liquor at the time?

I have selected a few cases of my own, which I shall briefly outline, demonstrating some of the points referred to.

CASE 1.—In this case the cross-examination had been particularly prolonged and severe, and as I was leaving the stand with the mental conviction that the man was guilty, but with the feeling that he would be acquitted on the testimony, I was recalled by the defendant's attorney. He informed me he had one more question to ask. "What conversation, if any, did you have with the prosecutor, and just what did she tell you regarding the assault?" I told the patient's story as she had told it to me, and the man was promptly convicted, and after the trial his attorney said: "Doctor, I asked you just one question too many." In this instance the prosecution could have obtained from me a true account of the case if he had only known it, as the little girl did not explain to the jury the methods used by her father. But for that "one question too many" the defendant would surely have left the court a free man. The story told me by this little girl of fifteen years was a very unusual one, and goes to prove the cunning of some brutes who are determined to accomplish their object, no matter by what despicable methods. "One year ago my father took me on his knee and, holding me in his arms, told me I should allow him to have sexual intercourse with me, explaining just what it meant. If I did not allow him to do this, he said some strange man would do it, and that would be very bad for me. If he did it to me, he said, a great good would come. I was frightened, but did not think my father would do anything to hurt me, so I let him do it. For one year this happened twice weekly, until about five months ago, when it became so painful that I could not stand it any longer." The examination of this girl disclosed destruction of the hymen, and enlarged and dilated vagina, with all the tissues exquisitely tender to touch. The vaginal mucous membrane showed marked bluish discoloration, soft cervix, and a uterus enlarged to what

would correspond to pregnancy at about seven months. Fœtal heart sounds were present. The girl had a profuse vaginal discharge, swarming with gonococci. I did not have the opportunity of examining the man. He pleaded guilty and was given a sentence of five years. I am unable to state the source or length of time of the venereal infection in the girl.

CASE 2.—I shall only give the outline of this case; it would be useless to note the details. Three sisters, aged eight, ten, and fourteen years respectively, told a similar story. Their father for the past two years had been abusing them in the most barbarous manner. He had not only committed acts unnecessary to mention but had compelled them in turn to perform acts of the most disgusting character. All three showed the most marked evidence of abuse, and were in a shocking state of venereal infection and neglect. I was compelled to send them to a hospital, where they underwent treatment for several weeks. The father, after pleading not guilty, was given a sentence of fifteen years. The mother of these children had been dead for several years.

CASE 3.—A fourteen-year-old colored girl claimed she had been assaulted by a boy much bigger than she, and that he had struck her in the face, rendering her unconscious, and before she revived he had ravished her. A striking point in this case was the finding of a chancroidal sore on the vaginal mucous membrane and a similar sore on the man's prepuce—facts which, I believe, helped the jury in deciding on a verdict of guilty. This boy was sentenced to three years.

CASE 4.—The accused in this case was acquitted mainly on the poor testimony of the prosecutor, who could not remember places and dates, although she told me a story which was partially borne out by facts. "My father had sexual intercourse with me six or seven times within the past seven months, and, although it was painful, I let him do it, as he had threatened to kill me and himself if I refused or told anyone. The last time he tried to do it I would not let him, and he beat me with a trunk strap." The girl showed a hymen lacerated in all directions, and had distinct evidences of the beating. The investigation of the man's character showed him to be a hard drinker and one who seldom worked. His wife had been dead several years, and he was living alone with his daughter. The question arose as to whether he was guilty of the offence as claimed by his daughter or whether she had not been led astray by someone other than her father, and received the beating from him in consequence.

CASE 5.—A little girl, six years of age, was submitted for examination following her accusation of improper conduct on the part of a man whom she fully identified. She told a plausible and likely story, giving date, place, and hour of the alleged offence and explaining what the man had attempted to do to her. The examination showed she was suffering from a profuse gonorrhœal discharge with accompanying acute inflammation about the genitals. The man did not deny that he had been with the child, but did deny that he had attempted to injure her. Examination of the defendant showed that he also had a gonorrhœal discharge, which in itself would have been of little value as evidence. On account of the child's age, six years, the Judge would not allow her to testify, the one witness called being the examining surgeon, who was allowed to state only his physical findings in the girl and the man. In this instance the jury was instructed to bring in a verdict of not guilty. This case illustrates my

previous observation, that gonorrhœa is prevalent in young girls. The fact that both the accused and the accuser are infected with the same venereal disease is not justification for an opinion as to the guilt of the man on the part of the physician. However, such a circumstance is at least suggestive of guilt if combined with other circumstances in the case which are reasonable as to fact.

CASE 6.—This was of a fourteen-year-old girl. "My father gave me candy and told me if I felt sleepy to go and lie down on the lounge. Shortly after I did feel sleepy and awoke to find him on top of me having sexual intercourse. It gave me great pain and I bled some. He did the same thing to me several weeks later." On examination I found a profuse vaginal discharge which proved to be non-gonorrhœal; the hymen was lacerated in all directions, with contracted edges. The girl was pregnant about six months, and denied sexual intercourse with anyone else. Five days later her family physician notified me that she had aborted a six-month-old fœtus. I talked with the father of this girl, and he freely admitted the sexual intercourse with his daughter, and was sentenced to three and one-half years, after pleading guilty. This man was the father of three girls.

CASE 7.—This little six-year-old child was so frightened that no history of the case was obtainable. The accused was arrested after being found in bed with the child. Examination of the vagina was difficult on account of the extreme tenderness due to acute inflammation. The thighs were excoriated by a profuse discharge of gonorrhœal origin. The hymen was found lacerated for about one-half inch, extending downward to the child's left. I talked with the accused and he freely admitted having had the little girl in bed, but "he was so drunk he could not tell me what had happened." The man's inguinal glands were enlarged, the left testicle swollen, and he showed considerable discharge from the urethra, which discharge I examined and found in it shreds and epithelium, but no gonococci. Three weeks later the Court sentenced him to a prison term of from seven to fifteen years. This case indicates that a plea of drunkenness is not accepted in the courts of Philadelphia as an excuse for rape or an attempt to rape. The finding of a lacerated hymen, without other evidence of trauma in this instance, showed that the laceration was caused by other means than the penis of the accused. There is a strong reason to believe that in such cases lacerations of this kind are caused by the man's finger.

CASE 8.—The following case illustrates the care that should be exercised in procuring an accurate history from the girl (M. A., aged fifteen years): "Two days ago three boys grabbed me and took me to a house where there were two other boys. They threw me on the floor, and while four of them held me the fifth had sexual connection with me." The physical examination of the girl was made in the presence of her mother and sister-in-law. The girl had insisted that it was the first time that such a thing had happened to her. Her mother was equally certain that her daughter was a virgin up to within two days of the offence. Separation of the child's legs disclosed a widely gaping vulva and an elongated vagina with smooth mucous membrane. Two fingers were easily inserted, which came in contact with a bilateral laceration of the cervix. I insisted in the strongest terms that the patient was not telling me the truth as to her sexual life, and I was finally rewarded for my persistence by the mother saying: "Now, ain't that a funny thing? I was just making up my

mind to tell the doctor the truth if he asked me that question." One I had repeatedly asked, viz.: Was this the first time the girl had suffered sexual intercourse? Answer: "She was in a little trouble eight months ago, but did not think that counted." The child told me subsequently that she had been accustomed to coitus for several years.

CASE 9.—This case shows the importance of making an examination of any suspicious stains found on the clothing of the girl. A white girl, aged four years, gave the following history to the examining surgeon and later to the writer: "A boarder in our house took me up to his room and put me on the bed. He then lifted up my legs and stood on the floor and took something long out of his pants and rubbed it against my legs until I got wet." The under-drawers of this child were submitted to me for examination of several stains, on and about the crotch. I found these to be irregular in outline, penetrating the fabric, of a yellowish color and a starchy feel. They were best seen by the aid of transmitted light. In the region of the stains there was a strong odor of fecal matter. I examined nine slides obtained by the method previously described, and the iodine solution gave the "Florence" reaction in all. In five of these slides I found from two to five spermatozoa. My examination was made five days after the alleged assault. This man was acquitted of the charge of assault principally by the poor testimony of a physician, who was absolutely ignorant of the conditions which he was required to examine. Although he saw the case one hour after the alleged assault, found an acutely inflamed vaginal mucous membrane, and the child's drawers stained by a recent discharge of seminal fluid, he was positive the inflammation was five days old and that the stain was not recent. He had not touched it "because he was afraid of becoming infected."

CASE 10.—I testified in court regarding this case the same day as Case 9, and it is instructive in showing the different type of assault, as is shown by the sentence. A colored girl, fourteen years of age, explained to me that a man, twenty-one years old, had had sexual connection with her six or seven times. She admitted that she did not object to the man's advances and rather liked the experience. She had also indulged in this pastime with other boys. The man freely confessed to the charge and said the girl had urged him to have sexual connection. The girl was shown to the jury as a female of ill-repute, and the man was sentenced to thirty days in the county prison. The girl was turned over to some charitable organization for training wayward girls.

CASE 11.—This illustrates the type of man who is sexually a degenerate and, as is so often the case, does not try to indulge in sexual intercourse, but merely to satisfy his passion on a child's clothes. A little girl, seven years old, was going home from school about mid-day and while crossing a lot was accosted by a man of twenty-nine years, who asked her if she was cold. The man took her in his arms and while holding one of his hands over her mouth exposed his penis and ejaculated between her thighs, outside her drawers. I examined the stains and found them to be seminal stains. The man pleaded guilty and was sentenced to five years.

CASE 12.—Again showing the vicious type of man the following is a good example. Two girls, aged respectively four and seven years, were taken by a man of fifty-one to a room, and while he sat on a chair he tied the younger child to him with a rope and while rocking backward and forward he satisfied his

desire, without any attempt to enter the child's vagina. Then he took the older girl, and, after extending her arms and widely separating her legs, tied her naked to the bed. Again he satisfied his lust without leaving any signs of traumatism. Both children told me he made no effort to penetrate the vagina.

CASE 13.—A robust white girl, eighteen years of age, feeble-minded. Her step-father had been having sexual intercourse with her for three months, after persuading her that it was right and necessary that he should do so and with threats to kill her if she told anyone. Examination showed an extensive laceration of the hymen, with extreme inflammation of the vulva and vaginal orifice, which exuded quantities of gonorrhœal pus. The girl's older sister explained that the man had attacked herself on two occasions, but that she had eluded his grasp, and that an older married sister had been locked in the cellar by the step-father and that he had attempted to rape her. The man's wife was suffering from dysuria and vaginal discharge, which was no doubt gonorrhœal, as the man was reeking with gonorrhœal pus. The poor, feeble-minded child told me that she had said "stop" to her father and had pushed him away the first time, but admitted to allowing him to have sexual intercourse a number of times, although it gave her great pain. No doubt her consent was obtained through fear.

CASE 14.—A case of interest, and one which caused an immense amount of investigation and study, was of a little girl, thirteen years old, who charged a man of forty-nine of rape. The girl's statement of the attack at first seemed rather ordinary and simple, but as the investigation progressed it became extremely complicated.

"I was in the kitchen yesterday, about seven o'clock in the morning, and my mother was out; he came downstairs and went to the back yard to feed the chickens. Then he came into the kitchen and shut both doors and took off his pants. He said: 'Let's do something,' and I said 'No.' Then he tore off my drawers and laid me on the floor and tried to get inside me. It hurt and I tried to call out, but he put his hand over my mouth. Then he said, 'That is not the right way to do it. You must stand on your feet, and bend over, with your hands touching the floor.' I got up and bent over and he got back of me, and told me to push against him hard. He did this for one-half hour and it hurt me a lot. I am sure it was his thing that he had inside me, as I looked between my legs and saw it. As there was some blood on me I then washed myself and put on my drawers. Then I had breakfast and went to school, and when I sat down I found my drawers were sticking to my legs. When I went home at lunch time I took them off and put them in the wash for my mother."

I had several talks with this child, one lasting over an hour, and, although she varied slightly in her statements, in the main she stuck to the important points of her story. She also said the first question her mother asked her on her return home was: "Where are your drawers?" This in itself was rather peculiar, as the girl had told me she had placed the drawers in the wash, as it was Monday. She likewise explained that her mother had warned her against the defendant "that something might happen to her."

The examination of the girl showed her to be a delicate child, weighing about seventy pounds, and about four feet six inches in height. She was highly

nervous and cried at frequent intervals. At times it was impossible to get her to look me in the eyes, and became easily confused, but would invariably return to her original statements as to the assault. She told me that this was the first time anyone had attempted to harm her in any way, and the closest questioning did not alter this statement by her. Although her mother had warned her "that something might happen to her" and that the man had removed his pants and torn off her drawers, she did not know what was going to happen, and that she did not know that she was going to come to any harm. Even after she had been on her back on the floor, and the man had tried to enter her, she did not try to escape when he told her "That is not the right way," and she got on her feet and stooped over. She informed me that the two doors of the kitchen were not locked, but just "shut," and the reason she did not run out was "because I did not think of it."

The local examination showed a recent laceration of the hymen on the girl's right side one-half inch in length, edges thin, tender to touch and inflamed. On the left side were found two lacerations which were contracted, non-sensitive, and evidently not of recent date. There was a very slight discharge from the vagina, which was found negative as to gonorrhœa. From the appearance of the laceration on the right side I would say it had the appearance of having been caused within the last forty-eight hours previous to my examination.

Careful explanation of the results of the examination was rewarded by the girl saying "that some two or three weeks ago this same man had put his finger inside me backward and that it hurt me an awful lot, and that I could feel his finger-nail cutting me." Strange she did not remember this previous to my examination, as I had asked her if this man had at any time hurt or abused her in any way. This had happened while she was on his lap, and she still loved him up to the time "he put his thing in me," and yet she kissed him good-bye after this happened.

The underdrawers of this girl were submitted to me for examination—the ones torn off previous to the alleged assault. I may say here that the girl's mother nearly fainted and said: "My child is ruined," when she first saw the undergarment, and then went to the saloonkeeper who employed her to ask his advice. (This was told me by the girl and her mother.)

The examination for suspected seminal stains was made thirty-eight hours after the alleged assault, and the drawers were still damp and moist. The entire crotch was stained by a dark-colored, sticky, and in some spots stiff, substance, which was irregular in outline, had penetrated the fabric. Now note that these were the drawers which the girl said were torn off just previous to the assault, and, she also stated, were clean previous to the attack. She put them on after washing the blood from her person, and did not know they were soiled until four or five hours afterward, when they stuck to her legs when she sat down. Also remember that the examination made thirty-six hours following the assault showed that there was very little vaginal discharge, and yet within four or five hours the drawers were found with the entire crotch smirched with a dark-colored substance. What is still more interesting, I again examined this girl and her underdrawers four days later and found the undergarment (which she had worn for three days) stained by three or four small spots the size of the thumb-nail; pale, dry, and evidently caused by the discharge from the recent laceration and consequent inflammation of the hymen.

Numerous tests of the drawers worn immediately following the assault failed to show any seminal fluid, but did indicate that it was the result of a *leucorrhæal discharge*—from what source it would be extremely interesting to know. Again, it is curious to note that my request to make the second examination was met by the girl's aunt getting up in court and protesting in loud tones against any such procedure, and was promptly rebuked by the presiding Magistrate.

I examined and talked with the accused, and his story was interesting. For years he had helped take care of the girl, as her father was dead, and had bought her clothing, food, etc. The girl loved him and called him papa. Her mother was a hard drinker, and the Society for Prevention of Cruelty to Children had been after her several years ago for neglecting her children. The mother was accustomed to visit a house of ill-repute, and would come to his house drunk and abusive. Three weeks ago he put her out of the house on account of drunkenness. The girl's aunt was the proprietress of the house in question, and he had forbade her coming into his house at any time. He said it was the aunt who was persecuting him.

He freely admitted that he had been alone with the girl on the morning of the alleged assault, and said he had gone through the kitchen to feed the chickens, and that the girl was in the room preparing breakfast. He also stated that on the evening of the day the alleged assault was said to have taken place the girl came to him on the front steps and, putting her arms around his neck, kissed him good-bye. (The girl admitted to this.)

He explained that years ago he had an affection of the throat and neck glands which had extended to his scrotum (this may have been parotitis), since which time he rarely has an erection, and never has any inclination to matters sexual. He made the positive assertion that on the night of the assault which is alleged to have been committed the mother had taken the girl to a house which he knew to be of ill-repute. Although he was positive of this, he had no witness to this fact.

He was a man standing five feet ten inches, and weighing 218 pounds; never had been married; had gonorrhœa when a boy. Examination showed a penis of small size and shrivelled up. The abdomen was pendulous and flabby. His reputation was of the best, and he never touched intoxicating liquors. Had been a night watchman in one place for eleven years.

Some of the many important points in this case which should be kept in mind are as follows:

1. The relative size of the man in relation to the girl—she a little, delicate thing, weighing about 70 pounds, and he of about 220 pounds, with a pendulous abdomen. Yet the girl stated that the man compelled her to stand on her hands and feet for one-half hour while he forced an entrance into her vagina.
2. The relation of the man to the girl's mother and aunt.
3. The character of the girl's mother and aunt.
4. The close relation of friendship of the girl to the man. Note

her kissing him good-bye after the assault, although she admitted to hating him at this time.

5. The demand of the mother for the child's drawers immediately on her return home, although the girl stated positively that she had placed them among the soiled linen on her return from school.

6. The girl's statement that she could not cry out, as the man had one hand over her mouth, but she was sure it was his thing inside her, "as she had looked between her legs."

7. It is most important to remember that the child was examined by a competent surgeon within twelve hours after the alleged assault and that he found a laceration of the hymen so recent that the edges of the tear bled to the touch.

8. The good character of the man.

9. The suspicion and warning of the girl's mother "that something might happen to the child during the mother's absence."

10. The drawers which the girl states were removed by the man before the assault were examined by me the following day and were damp with a number of large stains, and remember that she also said that she had washed herself before putting them on, "because there was some blood on her parts"; while, again, the drawers which the mother stated had been on three days and examined by me at the end of that time had only two or three stains about the size of the finger-nail.

One of the most famous and horrible cases of assault, and ending in murder, occurred in Philadelphia in the year 1879. I am unable to give the exact details about the rape but the following is about correct:

A man by the name of Parr raped his daughter and she became pregnant. He was sentenced to five years in the Joliet Penitentiary for this crime. Shortly after his discharge he called on his daughter, who had married while he was in prison, and attempted to rape the child, the girl baby born as a result of his attack upon his daughter. The mother of this child tried to defend it from her father's attack and was murdered by her father in consequence.

From the records of the Coroner's office in Philadelphia I find that "Susan Irwin, 34 years, married, of No. 631 Fitzwater Street, died from violence, the result of stab-wounds received at the hands of Edward Parr, May 6, 1879, in the rear of 631 Fitzwater Street." From the Court records: "Edward Parr, charge murder, June 2, 1879. The judge was John J. Elcock, the district attorney, Hagerty; the prisoner's attorney, Hampton L. Carson."

From the Philadelphia *North American* of June 10, 1879, I clip the following:

Judge Elcock had finished his sentence of death on Parr and the latter was asked if he had anything to say. "I have nothing to say but this: 'I did the act and am satisfied the law ought to take its course; and I further say that at the time the deed was committed I had no intention to do it.'" He then thanked his counsel and sat down, but was ordered by the Judge to stand up again, and he was sentenced to be hung. Scarcely had the sentence been passed when Parr passed his hands over his lips and fell forward as though in convulsions. He lay with his lips twitching; eyes closed and gasping for breath. He was removed to an ante-room and Dr. Chapman, the Coroner's physician, and Dr. Andrews, of the Jefferson College, and Coroner Gilbert were summoned. . . . He was gotten, after much struggling, under the influence of opium, and the stomach-pump used, followed by the injection of turpentine and of whiskey. From the description he must have suffered horribly, and died in the ante-room seventeen hours later. The autopsy showed an old fracture of the left side of the skull, which Dr. Chapman said "was from a fall forty years ago." The cause of death was strychnine poisoning, which Parr was supposed to have had concealed under a long thumb-nail. It is not known how he procured this poison, as the jailer stated "that he had given Parr a bath and a change of clothing the day before the suicide, and that only one person, a woman, had shaken the prisoner's hand, and that was several days previous to his death."

From the same paper, dated May 7, 1879, I find that Parr killed his daughter, Susan Irwin, at 631 Fitzwater Street, about 10.30 A.M. Twelve wounds were found on the body. He used a shoemaker's knife. Mrs. Irwin had a baby eighteen months old. In the *North American*, May 8, 1879, is the statement that Parr had served two years in the Eastern Penitentiary for assault with intent to kill; five years in the Joliet Penitentiary, Illinois, for an unnatural crime upon his daughter, and eighteen months for burglary. Years ago he was sentenced by Judge Biddle, in this city, to two years, in Quarter Sessions Court, the Judge remarking at the time: "I must say that you are the most wicked man that I ever had to deal with in a court of justice." The paper does not mention the nature of the crime committed.

To those interested in the subject of rape the recent illuminating report of the South African Commission under the chairmanship of Sir Melius de Villiers well shows "the black peril" existing there. Statements were received from over 300 persons as to the prevalence of rape, the number of cases reported increasing from 11 in 1901 to 80 in 1911 and 70 in 1912.

Electrotherapeutics

THE USE OF CERTAIN PHYSICAL AGENTS IN THE TREATMENT OF CANCER AND ALLIED DISEASES: (1) ELECTROCOAGULATION (DOYEN); (2) FULGURA- TION (DE KEATING-HART); (3) THERMORADIO- THERAPY (DE KEATING-HART)

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INTRODUCTORY REMARKS

It is one of the purposes of the Department of Research of the New York Skin and Cancer Hospital to endeavor to contribute to the solution of the cancer problem by what has been designated the direct method of investigation. This method calls for the treatment of the victim of malignant disease by various means with the hope of finding a cure, and thus, if possible, lead to the discovery of the cause of this widespread affection.

Whether this so-called direct method is more apt to reach the desired end at an earlier date than is the so-called indirect method, which seeks first to find the cause and then the cure, does not concern us. The patients afflicted with malignant disease must be treated as they come. Unfortunately, all cannot be cured by surgical intervention; some cannot be benefited. For this reason we have tested, from time to time, various agencies, physical, biological, chemical,

etc., which seemed to offer palliation or cure, and at the same time entailed no serious menace to the patient.

In accordance with this purpose of the Department of Research, we have installed at the New York Skin and Cancer Hospital the necessary apparatus for the utilization of certain electrotherapeutic measures which have been advocated and employed, with apparent success, in other institutions, particularly in European centres. We are now testing the efficacy of these methods, the following account of the work being in the nature of a purely tentative report, the final verdict, as the outcome of our experience, being reserved for a future time.

In order to become thoroughly conversant with the methods herein considered, the writer, as the representative of the New York Skin and Cancer Hospital, and as a surgeon greatly interested in the cancer problem, has studied these methods at first hand on various visits to Europe. Dr. Worthington S. Russell, of the Department of Electrotherapeutics of the same institution, has likewise investigated the methods under the tutelage of their respective authors. When the apparatus was installed, therefore, we felt reasonably sure that we could utilize it to the best advantage. Not content with this, however, Dr. de Keating-Hart was especially invited to visit New York, and personally to demonstrate the two methods of which he is the author. This invitation was accepted, and many surgeons from different sections of the United States and Canada witnessed his demonstrations and listened to his lectures. Dr. Doyen has not visited the Hospital, but through our close touch with his work in Paris it is felt that the method is carried out in accordance with his views.

Careful records have always been made of all cases treated by the different methods. We have now (June 1, 1913) treated 250 cases with fulguration, 40 with electrocoagulation, and 50 with thermoradiotherapy. From these numbers a few case histories have been selected, and are appended.

DEFINITION OF TERMS

Many errors in nomenclature have crept into the literature of electrotherapeutics, particularly with reference to the methods now under consideration. In order to avoid further confusion, it may not be amiss to attempt to give a succinct definition of the various

methods which are closely associated one with another, and which have been confounded. It is to be remembered that all these methods are applications of high-frequency currents of electricity.

The various procedures may be broadly considered as coming within the following general classification:

(1) *Cauterization*, or destruction of the growth, with monopolar or bipolar current, and with short spark, of high frequency, high tension, and low amperage, often inaccurately called "fulguration," sometimes described as "destructive fulguration," better, perhaps, "high-frequency cauterization."

(2) *Cauterization*, or destruction of the growth, by using a specially-constructed apparatus, with monopolar or bipolar current, and relatively low tension and high amperage. Rivière's method comes within this class.

(3) *Desiccation*, or the "drying out" of the growth, with a monopolar current, short spark of high frequency and high tension, the action of which is not carried to cauterization, but rapidly dehydrates the neoplasm and converts it into an inert mass. This is Clark's method.

(4) *Thermopenetration*, or the heating of the diseased tissue to a higher or lower degree, by means of a bipolar current of high frequency, relatively low tension, and relatively high amperage. The heating of the diseased mass may be carried to the point of tissue coagulation. Diathermy (Nagelschmidt) and electrocoagulation (Doyen) are types of this method. When only such a degree of heat is employed as will render the tissues more radiosensitive, the term thermoradiotherapy (de Keating-Hart) has been employed.

(5) *Fulguration*, or the application, *to the area from which all macroscopic evidence of malignity has been removed*, of a monopolar current of high frequency, high tension, relatively low amperage, with a cooled long spark. This is the method of de Keating-Hart.

ALTOFREQUENT CYTOLYSIS, ALTOFREQUENT SCINTILLATION,
EFFLEUVATION, ETC. (RIVIÈRE)

It seems to be generally conceded that Rivière, of Paris, was the first to employ the high-frequency discharge with a current of sufficient energy to destroy living tissue. His method of treating malig-

nant tumors by high-frequency sparking and effleuves, to which, he declares, the term "fulguration" was subsequently applied, was first described by him in 1900, and reviewed in 1909. He maintained that every operation for malignant growths should be immediately followed by the application of high-frequency sparks and effleuves for the purpose of preventing the contamination of the open surgical wound and to prevent recurrence. He did not advocate the removal of large tumors by this means, surgical excision being the method of election in such cases. He did maintain, however, that high-frequency currents, and, more especially, the monopolar effleuves of Oudin's resonator, seem to exercise a thermo-electrical-chemical action, which, by modifying the vitality of the regions newly contaminated by the surgeon's knife, disinfected them and tended to prevent recurrence.

DESTRUCTIVE FULGURATION

The term "destructive fulguration" is sometimes applied to the ordinary high-frequency electrocauterization employed by many surgeons and electrotherapeutists in the treatment of benign and malignant neoplasms. In this method a bipolar current with a short spark is utilized for "burning down" the growth. With a special apparatus a monopolar current with long spark, as described by Rivière, may be used. The application with various machines of the high-frequency current, with short spark, is the method most frequently referred to as fulguration, and which is most commonly confounded with the fulguration of de Keating-Hart. It is also designated as "electro-carbonization."

OSCILLATORY DESICCATION (CLARK)

The method of Clark consists in the production, the control, and the sustaining of heat sufficient to cause the rapid dehydration of the part being treated, its sterilization, and conversion into an inert mass. This is accomplished by a specialized, true, oscillatory high-frequency current, concentrated to a very fine metal point, and delivered in sparks of great frequency through an air space to the tissue. He employed a static machine with a large output (3 to 6 milliampères).

This method is often referred to as fulguration. Clark does not accept "destructive fulguration" as being identical with his method

of "desiccation." The thermic degree, he says, is too high, and the impact against the tissues too severe. How different this method is from that of de Keating-Hart will be seen when the latter is described.

THERMOPENETRATION (D'ARSONVAL)

The power of the high-frequency current to cause a decided rise of temperature in tissues interposed between two electrodes was demonstrated by d'Arsonval in 1896. This property of thermopenetration has been variously utilized by different investigators. By some, notably de Keating-Hart, it has been utilized for the purpose of heating the tissues with a view to rendering them more radiosensitive; by others (Nagelschmidt and Doyen), for the destruction of neoplasms. The latter use has probably led to its being confounded with fulguration.

DIATHERMY, TRANSTHERMY (NAGELSCHMIDT)

In 1907 Nagelschmidt, in Berlin, von Brendt, Preeps, and Zeyneck, in Vienna, and de Kraft, in New York, experimented independently with the thermopenetrative power of the high-frequency current. The method has become generally known under the designation applied by Nagelschmidt, *diathermy*. The apparatus employed elevates the temperature of the deep tissues to any required extent, the tumor being destroyed by the coagulation of the tissues. This is merely a thermic means of destruction, which has no trophoneurotic action, as is claimed for the Rivière and the de Keating-Hart methods.

Nagelschmidt has called attention to the fact that on passing a high-frequency current through a patient a rise of temperature may be noted, as shown by the thermometer, this rise being largely proportional to the amperage. The greater the amperage, the greater the heating. Nagelschmidt employs a special apparatus of high amperage and relatively low voltage, which has a range from zero to $2\frac{1}{2}$ ampères. As will be seen later, this machine is not so powerful as that employed by Doyen.

In this method the current may be applied merely to the extent of heating the tissues, as in the treatment of rheumatism, sciatica, etc., or it may be carried to a sufficient degree to cause tissue coagulation, as in the destruction of accessible malignant or benign growths,

the removal of tonsils and adenoids, etc. In the treatment of cancer Nagelschmidt coagulates a layer and removes it, then coagulates another layer, and so proceeds until the entire mass is removed. In this respect, as well as in the power of the machine, his method differs from that of Doyen.

BIPOLAR VOLTAIZATION (DOYEN)

The term bipolar voltaization is applied by Doyen to the method in which the electrode of his apparatus is held away from the part being treated, the sparks being allowed to play upon the area. A superficial carbonization takes place, the underlying tissues being coagulated, the same as when the electrode is placed directly in contact with the part, though not to the same depth.

FULGURATION (DE KEATING-HART)

Theoretical Basis of Fulguration.—The premise upon which the de Keating-Hart method of fulguration has been developed is that the *monopolar long spark of high frequency and high tension acts not upon the neoplasm, but upon the soil on which the neoplasm has developed.*

The purpose of sparking in this manner the area from which all macroscopic evidence of malignity has been removed is to modify the local trophism in such way that any remaining cancer-cells, being badly nourished, will tend to retrograde, the probability of recurrence being thus lessened. According to this theory, the action is not dependent upon the heat effects of the spark; the important factor is rather the sedation of the cancer-cells. The application of the spark, however, may be carried to the point of the immediate destruction of tissue by heat, provided the electrode is centred upon a given area, instead of being kept in constant motion, as insisted upon by de Keating-Hart. This latter application is distinctly *not* fulguration as the term is employed by de Keating-Hart.

The premises upon which de Keating-Hart based his theory are the three following groups of alleged facts:

(1) That sparking, even when combined with an inadequate surgical operation, gives undeniable results; insufficient, perhaps, but already definite.

(2) That the tumor is in no way modified in appearance or vitality, from which one may reasonably conclude that it is not the tumor itself, but the condition of its nutrition,—that is to say, the environment in which it develops,—that is transformed.

(3) That laboratory experiments and clinical observation furnish plausible explanations of the foregoing.

It is not within the province of this article to detail the experiments which de Keating-Hart and others have conducted for the purpose of determining the action of fulguration upon malignant neoplasms. These have been fully described elsewhere.

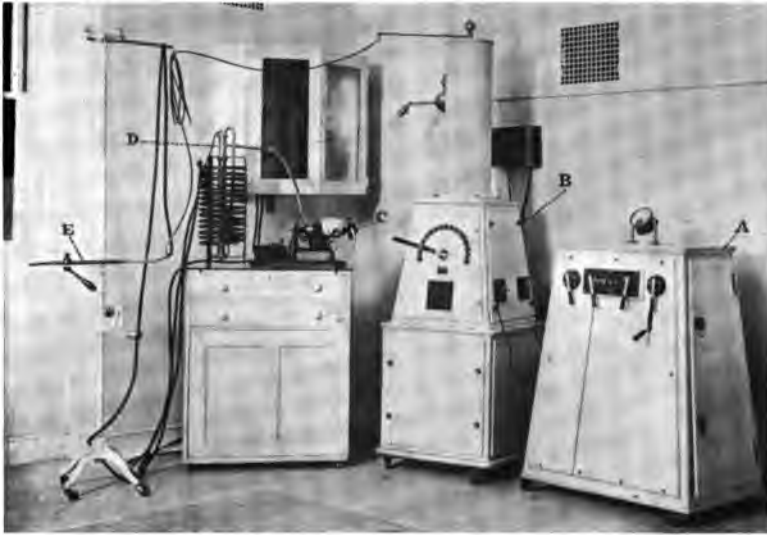
It is claimed by de Keating-Hart and others that the employment of the high-frequency short spark (from one to four centimetres), at a relatively low tension, produces the effect of cellular stimulation; it provokes a rapid cicatrization of wounds, and exerts a remarkable action upon torpid ulcers. On the other hand, the high-tension spark of a minimum length of eight centimetres, applied for a sufficiently long period of time in proportion to the surface fulgurated, retards cicatrization and transforms a given area into a torpid wound. The wound fills up, but the surrounding healthy tissue contracts. There is, according to de Keating-Hart, a natural autoplasty, not a cicatrization. He considers that the same trophic phenomenon that prevents the re-formation of healthy epidermis after fulguration also retards or suppresses the propagation of cancer *in situ*. By this method the microscopic cancer-cell, not the macroscopic growth, is attacked indirectly and destroyed.

Apparatus.—The de Keating-Hart outfit (Fig. 1) consists of the following apparatus:

(1) *The Generating Apparatus (A)*, which encloses a large coil and a rapid interrupter, the purpose of which is to convert the ordinary street current of low voltage and high amperage into an interrupted current of extremely high voltage and correspondingly low amperage. On top of the cabinet is an ampèremeter for measuring the number of ampères passing into the coil, while on the front are seen the various switches of control.

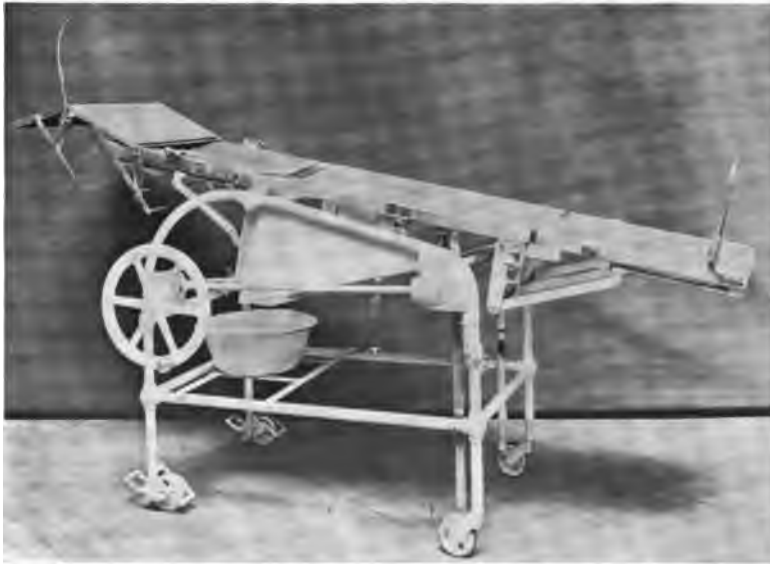
(2) *The High-Frequency Apparatus (B)*, which comprises an Oudin resonator with spark-gap and condensers of great capacity. The current passes through the cable from the long terminal at the

FIG. 1.



Fulguration (de Keating-Hart) outfit: *A*, Generating apparatus. *B*, High-frequency apparatus. *C*, Sterilizing and cooling apparatus. *D*, de Keating-Hart electrode.

FIG. 2.



Bainbridge metal operating table.

FIG. 3.



Condition before operation, May 23, 1912. (Case I.)

FIG. 4.



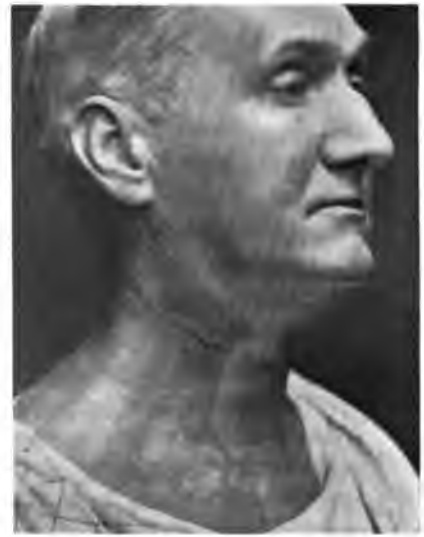
Condition December 15, 1912. (Case I.)

FIG. 5.



Condition of wound December 2, 1911. (Case II.)

FIG. 6.



Condition when discharged from hospital, December 20, 1911. (Case II.)

top of the resonator to the electrode. The current produced is one of great frequency.

(3) *The Sterilizing and Cooling Apparatus*, consisting of an air-pump driven by an electric motor (*C*), which forces filtered air through an electric sterilizer (*D*), and on through a number of copper coils. These serve to cool the air, which is finally delivered at the electrode cool and absolutely sterile. The circulating air keeps the rubber insulation of the electrode from being burned by the spark, and also blows the blood and detritus away from the wound during the application of the spark.

(4) *The de Keating-Hart Electrode (E)* is composed of a metal mandril sliding snugly within an insulating tube of hard rubber. It is collected with the cable which conducts the current from the terminal on top of the resonator and with a rubber tube through which passes the sterilized air. The length of the spark is regulated by drawing out the mandril from its rubber sheath the necessary distance, as shown on a graduated scale of centimetres cut on the side of the mandril. The sterilized air is forced through the tube and along the side of the mandril, escaping from the point of the electrode.

(5) *An Operating Table*, of wood or metal, is employed. When a wooden table is used it must be grounded in order to prevent burning the patient; with a metal table this is unnecessary. Fig. 2 shows the Bainbridge metal table which is employed in fulguration operations at the New York Skin and Cancer Hospital.

Surgical Technic.—The first step in fulguration is purely surgical, for it is to be borne in mind that this is essentially a method of treatment for *operable* cancers. The surgical procedure, which depends entirely upon the exigencies of the case, need not be given here. The more complete the removal of diseased tissue, the more certain, according to de Keating-Hart, is the freedom from recurrence. The possibility of complete cure and absolute prevention of recurrence is commensurate with the extent to which eradication may be carried. Where only partial removal of malignant tissue is possible the method of fulguration is palliative rather than curative, and in many such cases thermoradiotherapy is advocated.

Electric Technic.—The general rule laid down by de Keating-Hart is as follows: Spark for a long time, using powerful sparks of high frequency and high tension, applying them to the area from

which every macroscopic trace of cancer has been removed. It is, then, *under* the cancer, and not *upon* it, that the electrical discharge is applied.

The spark should be white, producing the sensation of a violent shock, its mean length to be from ten to twelve centimetres as a minimum. An important detail of the electrical technic is to utilize the spark at its maximum length. The electrode should be kept in constant motion, and should be regularly passed over the surface being treated. The reason for this is twofold: (1) In order to avoid carbonization of the points at which the sparks strike the tissue; (2) in order to equalize the dosage save at suspected points where one must work energetically.

The dosage, or the duration of the application of the spark upon the given point, cannot be established in other than an empirical manner. It is not difficult to comprehend the reason for this when one realizes that no two apparatus are exactly alike, and that in the same apparatus there may be great variation in the primary current, the distance of the spark-gap, and the conductivity of the air which surrounds it, all of which exert an influence, as does likewise the insulation of the patient. Under such conditions the electrical properties of the spark are subject to enormous variation. As a general rule, however, one may advise "ten minutes of fulguration for an area of ten square centimetres."

Another guide in the matter of duration is the change in the color of the tissues being fulgurated. All tissues take on a slightly darker tinge, not from destruction, but from the deposit of small blood-clots produced at the surface through contact with the spark. This change of color varies with the tissue involved; the muscles assume the tinge of smoked meat, while the bones become slightly yellow. These appearances, however, are apt to be deceptive, depending upon the manner in which the sparking is carried out, and upon the thickness of the sanguinolent fluid through which it passes. As a rule, bones should not be fulgurated as long as muscles, or vessels as long as tendons.

Clinical Results.—It has been claimed by de Keating-Hart that all forms of cancer have responded to fulguration. In advanced cases he has noted important palliative results, such as the suppression of pain and hemorrhage, cicatrization, increase of strength, and pro-

longation of life, in more than 70 per cent. of the tumors treated by this method. Cancer of the breast has given him 39.5 per cent. of cures. Cancers of the buccal mucosa have yielded 83 per cent. of freedom from recurrence for periods varying from seven and a half months to two years. He reports 89 per cent. of successes for a mean duration of 16 months in inoperable sarcomata treated by fulguration.

It is well to bear in mind that the nature of the method and its combination with radical surgery tend to make one cautious in accepting the results as more than apparent cures until a longer time has elapsed and a larger number of observations have been published. In the light of our present knowledge of cancer, it is difficult to say just how much of the benefit, temporary or permanent, may be due to fulguration and how much to radical surgery.

The following cases have been selected from the 250 which have been treated by this method at the New York Skin and Cancer Hospital.

CASE I.—*Melanotic Epithelioma of Ear.*—S., male, aged 65. Ulcer of ear for fourteen years. Varied treatment—caustics, X-rays, etc. Improved for a time under X-ray treatment, but recurrence took place, and for the past two years he has been getting worse. Fig. 3 shows condition when patient consulted me, May 20, 1912. Curettage and fulguration, May 23, 1912. Perfectly well, June 1, 1913, without deformity, as shown in Fig. 4, taken December 15, 1912.

CASE II.—*Recurrent Carcinoma of Neck.*—H., male, aged 55. In January, 1907, a tumor was first noticed at the base of the right side of the neck. In March, 1908, the growth was removed in Philadelphia but rapidly recurred. A second operation was performed, this time in Richmond, Va. The patient was then told that nothing more could be done for him, the growth being in part irremovable. In August, 1911, a second recurrence appeared at the site of the operations. This bled freely. On November 16, 1911, I operated upon him, ligating and removing two inches of the internal jugular vein, which had been eroded by the cancer, removing as much as possible of the diseased tissue about the common carotid, the larynx, the cricoid, and the thyroid cartilages, and dissecting out the glands of the neck. The thyroid cartilage on the diseased side was so extensively involved that in curetting I went down to the mucous membrane, but it was impossible to excise all of the diseased tissue. The open wound was fulgurated and then closed, an ample opening being left for the lymphorrhœa which always follows fulguration. Fig. 5 shows the condition of the wound on December 2, 1911, healing being complete except for a small sinus at its lower part. On December 4 I opened up freely the neighborhood of the sinus, and, after curetting, Dr. de Keating-Hart fulgurated. The patient was discharged from the Hospital December 20, 1911, his condition being depicted in Fig. 6. At the present time (June 1, 1913) the patient is perfectly well, with no recurrence, has gained over 50 pounds in weight, and has been back on

duty as a police officer for over a year. Fig. 7 shows his condition two weeks after he left the Hospital.

CASE III.—*Recurrent Epithelioma of Cheek*.—T., male, aged 56. In 1902 a small growth was removed from his right cheek. Recurrence followed, and in 1904 another operation was performed. In 1905 a second recurrence occurred. This was treated by numerous applications of X-ray, arsenic pastes, etc., the benefit being only temporary. In September, 1911, because of the intense pain caused by pressure of the growth upon his eye, the eye was enucleated. The antrum was opened at this time, and found to be filled with pus. It was impossible to remove all of the diseased tissue. X-ray treatment was resumed, but the growth increased steadily. On January 13, 1912, the patient entered the New York Skin and Cancer Hospital for the purpose of receiving the fulguration treatment. Fig. 8 shows his condition at that time. Upon operation an extensive growth was found which necessitated the removal of part of the malar bone, the superior maxilla, and part of the roof of the mouth, exposing the vomer and the under surface of the dura at one point. The entire operative field was then fulgurated. Fig. 9 shows the condition on January 27, two weeks after operation. The patient went home, returning in October, 1912. A denture was then made to fill in the opening in the roof of the mouth. Fig. 10 shows the denture in position, October 9, 1912. There was no sign of recurrence about the wound, but several small growths had appeared on the right ear, the end of the nose, and the cheek. These were curetted and fulgurated. In January, 1913, the patient, who is a physician, was free from recurrence, and had resumed his practice. Perfectly well in June, 1913, and seriously considering returning for a plastic operation in order to discard the denture.

CASE IV.—*Prickle-cell Epithelioma of Lip*.—H., male, aged 37. Three years previous to operation a crack appeared in the centre of the lower lip. This failed to heal and finally became hard and elevated. It was treated with salves, powders, and caustics until his admission to the New York Skin and Cancer Hospital, in February, 1912. The macroscopic growth was excised February 6, without a radical operation. The glands of the neck were removed, and both areas fulgurated. Fig. 11 shows the condition before operation; Fig. 12 the condition November 15, 1912.

CASE V.—*Epithelioma of Lip*.—G., male, aged 37. In October, 1911, a "sore" appeared on the lower lip, which grew steadily until it reached the proportions shown in Fig. 13. Cauterized by his physician several times previous to his admission to the New York Skin and Cancer Hospital, January 5, 1912. Curetted and fulgurated, January 8, 1912. The wound healed readily except for a small area in the centre which proved, upon microscopic examination, to be epitheliomatous. Fig. 14 shows the condition on March 4, 1912, at which time healing seemed to be practically complete. Several X-ray exposures were given, but the condition grew worse, and a second curettage followed by fulguration was resorted to on March 13. The process extended over the lower jaw, which was resected by my colleague, Dr. E. M. Foote, July 24, 1912, during my absence. The second operation did not serve to stop the disease. After temporary retardation he went rapidly on to death, November 9, 1912 (Fig. 15).

In this case the progress was continuous in spite of all treatment, although there was definite improvement at first, with temporary retardation. Whether the dosage of fulguration was insufficient, or further fulguration would have

FIG. 7.



Condition May 1, 1913. (Case II.)

FIG. 8.



Condition upon admission to Hospital, January 13, 1912. (Case III.)

FIG. 9.



Condition of wound on January 27, two weeks after operation. (Case III.)

FIG. 10.



Condition October 9, 1912, with denture in place. (Case III.)

FIG. 11.



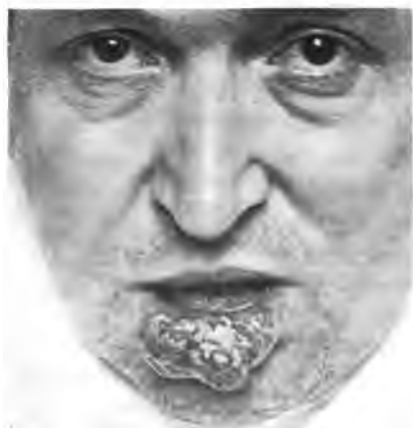
Growth before operation, February 7, 1912.
(Case IV.)

FIG. 12.



Condition on November 15, 1912. (Case IV.)

FIG. 13.



Condition upon admission to hospital, January
8, 1912. (Case V.)

FIG. 14.



Condition on March 4, 1912. (Case V.)

stayed the progress of the disease, cannot be determined. There may be types of cancer which cannot be benefited by fulguration, whereas other types may be benefited materially. This is a matter for further observation. In order to arrive at the truth regarding the method, cases which seem to be affected unfavorably should be carefully considered.

ELECTROCOAGULATION (DOYEN)

Theoretical and Experimental Basis of Electrocoagulation.—It has been stated that utilization of high-frequency currents of electricity for the purpose of elevating the temperature of the part being treated dates back to 1896, when d'Arsonville made the discovery.

In electrocoagulation, as employed by Doyen, the heating of the tissues is carried to such an extent that complete destruction results. He conducted a series of experiments to determine the thermal death-point of various cells. As a result of these investigations he advanced the opinion that cancer-cells are much less resistant to heat than are normal cells. By employing very sensitive thermometers, and after a number of corroborative tests, he reached the conclusion that cancer-cells are destroyed by a temperature of between 50° and 55° C. (122°–131° F.), while normal cells are resistant up to 60° C. (140° F.).

The above theory having been demonstrated to his satisfaction, Doyen proceeded to find a form of heat that would penetrate the deep tissue and at the same time destroy the cancer-cells lying therein. Hot air, superheated steam, and hot water respectively, were employed, but were found to exert absolutely no effect after reaching a depth of from four to five millimetres.

Having abandoned these measures, Doyen next turned his attention to the use of sparks of high frequency, which had already been shown by Rivi re and Pozzi to exercise a destructive effect upon tissue.

After studying the action of these sparks upon the deep tissues, and their effects upon cancer-cells located therein, Doyen announced that the heat produced by currents of sufficient strength causes coagulation of tissue and destruction of cancer-cells, even at a considerable depth, without injury to the more resistant normal cells at the same depth. The apparatus described below is the outcome of these investigations, and is the one which we have been employing for some months at the New York Skin and Cancer Hospital.

Apparatus.—The electrocoagulation apparatus of Doyen (which

may be employed also for diathermy according to the method of Nagelschmidt, and for thermoradiotherapy according to the method of de Keating-Hart) is shown in Fig. 16. It consists of the following parts:

(1) *The Transformer (A)*. This is fed by an alternating current, and produces a current of high voltage, though not so high as that produced by the coil employed in fulguration.

(2) *The Switchboard (B)*. This is mounted on rollers for convenience, and contains rheostats for controlling the strength of the current and the speed of the motor, an ampèremeter, and a switch.

(3) *The Table (C)*. This is also mounted on rollers, and has at its upper part and within the box a rotary sparking device consisting of a large-toothed wheel, made to revolve very rapidly between two copper plates, connected on one hand with the current passing from the coil and on the other hand with a d'Arsonval condenser. The sparks pass between the teeth of the revolving wheel and the copper plates. A milliampèremeter, placed on the front of the box, measures the current passing through the patient. On top of the box may be seen the two electrodes employed in electrocoagulation, the indifferent electrode (*D*) and the active electrode (*E*), in an insulating handle.

Technic of Electrocoagulation.—Doyen found that the best results were obtained by placing the patient in contact with a metallic table connected with one extremity of the high-frequency apparatus, while the other extremity was connected with the active electrode placed in the insulating handle. This technic has been modified so that the patient is now insulated on a thick rubber pad. The active electrode is placed directly in contact with the tissue, thereby suppressing all sparks. When the electrode is held a distance from the part under treatment, thus allowing a shower of very short sparks to play upon the area, the method is designated bipolar voltaization, as previously stated. This latter method is not under consideration here.

The apparatus as now employed produces a current of about 3,000,000 oscillations per second, and of a strength of from 10 to 15 ampères. The power of this current may be realized when it is stated that if a sheet of foil be placed in the interior of the solenoid, and in the plane of one of the coils, it will be instantly melted.

With this apparatus and using a circular electrode three centi-

FIG. 15.



Condition October 14, 1912, three weeks before death. (Case V.)

FIG. 16.



Apparatus for electrocoagulation (Doyen), diathermy (Nagelschmidt), and thermoradiotherapy (de Keating-Hart): *A*, Transformer. *B*, Switchboard. *C*, Table. *D*, Indifferent electrode. *E*, Active electrode, in an insulating handle.

FIG. 18.



Condition when operated, October 31, 1912.
(Case VI.)

FIG. 19.



Condition on April 14, 1913. (Case VI.)

FIG. 20.



Thermoelectric apparatus for measuring the temperature of the tissue in thermoradiotherapy: A, Needle being heated in copper vessel (B). C, Needle, for plunging into tissue. D, Galvanometer. E, Thermometer for showing temperature of water.

metres in diameter it is possible to coagulate tissue to a depth of from five to eight centimetres in from one to two minutes.

It is important to note that the electrodes vary in shape and size, and must be carefully selected for each case. Disks of different diameters are employed upon flat surfaces, such as the skin and mucous membrane, cylindric forms of different size are used in deep parts, and olive-shaped bodies are employed for treating areas in cavities. The last-named form of electrode is semi-insulated in some instances, for use in special situations, as in the rectum, where it is necessary to localize the action without affecting the surrounding tissue.

It is an important part of the technic to note that the effect produced by placing the electrode in contact with the tissue, as in electrocoagulation, is distinctly different from that produced when the sparks are allowed to pass to the part, as in bipolar voltaization. In the first instance the tissues are coagulated to a depth varying according to the duration of the application. The temperature within the coagulated zone reaches to from 65° to 70° C. (149°–158° F.), while beyond this is an area, 10 to 15 millimetres thick, in which there is a decreasing temperature of from 65° to 38° C. (149°–100° F.) from the line of coagulation to the limit of unheated portion, as shown in Fig. 17. When, on the other hand, bipolar voltaization is employed, there is superficial carbonation in addition to coagulation in the underlying tissue. In this instance, however, the coagulation does not reach the depth produced by electrocoagulation. The temperature is as high as 500° to 600° C. on the surface of the carbonized area. It is plain to be seen that the method calls for extreme care in technic, fine judgment in the selection of the electrode according to the area to be treated, and the employment of a current proportional to the surface of the electrode selected.

The actual technic of electrocoagulation is as follows: Place the indifferent electrode in contact with the skin of the abdomen after the patient has been placed on the rubber insulating pad. Place the active electrode, equal in diameter to the size of the lesion (this applies to skin and mucous surfaces), in contact with the lesion. The current is then allowed to pass for from 20 to 60 seconds, according to the size of the cancerous mass. During the operation an assistant keeps the indifferent electrode wet by directing a stream of water

upon it. If any portion of the cancer is left undestroyed a second application may be necessary at another time. The slough is usually detached in from 10 to 15 days, leaving a granulating surface. The same technic is followed in cavities, the olive or cylindric electrodes

FIG. 17.

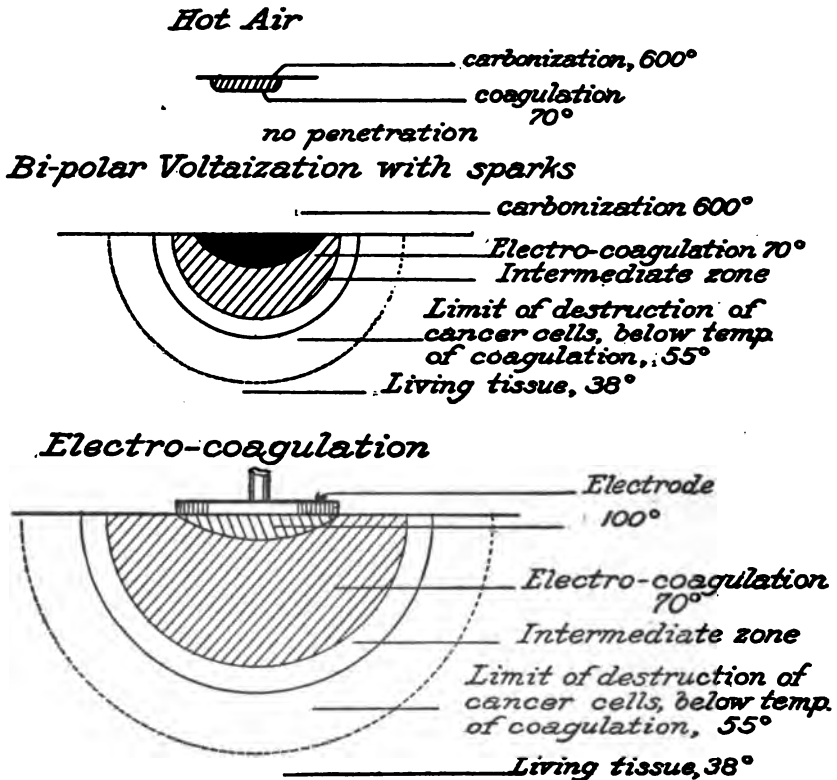


Diagram showing the effect of hot air, bipolar voltaization with sparks, and electrocoagulation on living tissues.

being employed in these cases, care being taken to reduce the necessary sparking to a minimum.

In certain cases, as in cancer of the bladder, it is necessary to resort to surgery in order to reach the part affected. In other cases surgery forms no part of the method, in which respect electrocoagulation differs from fulguration.

Considerable lymphorrhœa follows the use of the Doyen method, just as is the case with the de Keating-Hart fulguration.

Clinical Results.—Cancer in various parts of the body has been

treated by Doyen and his coworkers, and by others in institutions where the apparatus has been installed. Very little pain follows the treatment. Occasionally there is secondary hemorrhage due to the dislodgement of a clot. Up to date we have employed the method at the New York Skin and Cancer Hospital in 40 cases, one of which number is briefly detailed below.

CASE VI.—Carcinoma of Face Involving Superior and Inferior Maxillæ.—E., male, aged 72. Eighteen months before admission to the Hospital a papule the size of a pea appeared on the buccal mucosa. This was snipped off by his physician. Six months before admission recurrence took place in the scar, and, despite a series of X-ray treatments, the development was very rapid, reaching the proportions shown in Fig. 18. The patient was admitted to the Hospital, and on October 31, 1912, I excised the edges and coagulated the mass by the method of Doyen. The fetid area was cleaned up, as shown in Fig. 19, which represents the condition on May 14, 1913. Several treatments have been given in this case, rendering the patient more comfortable, but it is hardly to be expected that a cure will result.

THERMORADIO THERAPY (DE KEATING-HART)

Thermoradiotherapy is a method of thermic penetration with the addition of the cooling of the skin over the area being treated. The purpose of the application of heat is to render the diseased tissue more sensitive to the action of the X-rays; the purpose of the cooling of the surfaces is to prevent the danger of X-ray dermatitis.

The method is based upon the hypothesis that, other things being equal, the radiosensitiveness of tissues depends upon their temperature. In other words, the higher the temperature (between normal vital limits), the greater the destructive power of radiation upon them.

Apparatus.—In addition to the Doyen apparatus (Fig. 16), which may be employed, and the X-ray apparatus, which need not be described, the method now under discussion calls for a *thermo-electric apparatus for measuring the temperature of the tissue* (Fig. 20). A needle (A) is placed in a copper vessel (B) containing hot water of a known temperature, as measured by the thermometer. A second needle (C) is plunged into the tumor substance. Both needles are connected with a delicate galvanometer (D), which registers the difference between the two temperatures. Knowing the temperature of the water and the difference between the two temperatures, it is a simple matter to compute that of the tumor mass.

Technic of Thermoradiotherapy.—The heating of the tissues may be accomplished in the following ways:

(1) In the case of tumors with abundant blood supply, such as sarcomata, physiological hot serum is injected at 50° C. and in such a quantity as to raise the internal temperature of the neoplasm to about 41° or 42° C.

(2) In case of cancer developed in the natural cavities (rectum, vagina, stomach), irrigations as warm as can be borne are used during a time varying with the needs of the individual case.

(3) In tumors of woody consistency, that can be heated neither by injection nor irrigation, high-frequency currents are employed, either by passing the current through needles thrust into the skin, or through an electrode placed on the skin surface. This method is not new.

In order to obviate the danger of X-ray dermatitis in the tissues rendered more radiosensitive, de Keating-Hart conceived the idea of cooling the organs to be protected. This is accomplished chiefly by two means:

First, the surface is covered with cracked ice wrapped in cotton.

Second, a special apparatus may be employed which cools by blowing on the dampened surface with bellows.

Whenever possible, X-rays should be applied during the heating of the cancer, especially when the neoplasm is small and superficial. If the mass is deeply situated, as in uterine cancer, it may retain its warmth long enough for the irradiation to follow immediately after the warming process. The irradiation must be subjected to the usual rules of radiotherapy. Care must be exercised to prevent auto-intoxication from too rapid cytotoxicity.

Clinical Results.—Thermoradiotherapy may be employed in conjunction with fulguration in operable cases of advanced cancer. In inoperable cases, and with patients who reject all operative interference, it may be brought into requisition as a palliative measure. De Keating-Hart has reported remarkable results with the method, and we have employed it in 50 cases, with varying degrees of success, the histories of two of which, one of cancer and one of Hodgkin's disease, are briefly detailed below.

CASE VII.—*Recurrent Carcinoma of Chest Wall, with Mediastinal Involvement.*—L. F., a woman, aged 49. The right breast had been removed for

carcinoma, January 18, 1910, by another surgeon. Recurrence followed, causing great pain and necessitating daily doses of morphine. In January, 1912, we began treatment by means of thermoradiotherapy. Six treatments were given, at irregular intervals, the last on April 8, 1912. The glands became much smaller and the pain was relieved to such an extent that opiates were no longer necessary. Metastasis of the lungs occurred, and the patient died October 24, 1912. Up to the time of her death there was no return of the pain.

De Keating-Hart has maintained that certain conditions, presumably allied to cancer, may be benefited by thermoradiotherapy. He has reported a number of such cases. In employing the method we have borne this in mind, and append herewith the history of one such case.

CASE VIII.—*Hodgkin's Disease*.—J. N. S., male, aged 54. The disease first manifested itself in the glands of the left side of the neck, in March, 1911. The glands were removed in May, 1911. After operation other glands on the same side began to enlarge, and in July of the same year those of the other side of the neck, also the glands of both axillæ. The patient suffered great pain. He was referred to the New York Skin and Cancer Hospital in October, 1912, and treatment with thermoradiotherapy was begun on October 28. Twenty-seven applications have been made to the different groups of glands. Many of the glands have returned to their normal size, while others are very much smaller than when the treatment was instituted. The pain has completely subsided, and the patient has gained in weight, being now able to work every day.

SUMMARY

It may be briefly stated, in closing, that our own application of the methods above described is of entirely too short duration to warrant any statement as to their curative value. A much greater length of time, a larger series of cases, a clearer knowledge of the action of electricity, however employed, upon normal and abnormal tissues, and more definite knowledge concerning the etiology of malignant growths, are all necessary in order to estimate the efficacy of any method of treatment in these diseases. It must always be borne in mind that such methods of treatment may be fraught with harm as well as good, and their employment should be safeguarded in every way. The cases presented are given merely in the way of a report of progress in the testing of the methods. When our observations shall have been multiplied many times, and months shall have passed into years, a final report, from our point of view, may be given concerning the value of fulguration, electrocoagulation, and thermoradiotherapy in the treatment of cancer and allied diseases.

BERGONIE TREATMENT OF OBESITY AND CARDIOPATHY

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"LITTLE do (*sic*) the faculty imagine the misery and bitterness of life through the parasite of corpulence or obesity." So wrote Mr. Banting in a letter on corpulence forty years ago. At the present date, however, this condition is being recognized as a disease, and one to be treated by the profession; not that this recognition is really a novelty, since it obtained in 1850, when Erastus wrote "*De Pinguidine*."

That obesity is a disease, and a disease leading in some cases to serious and even fatal complications, is generally admitted. The derivation of the word is misleading: *obesus*, corpulent—from *ob* and *edo*, fully fed; for it by no means necessarily follows that the very corpulent person is either a large or injudicious eater; for, while an excess of food may be a determining cause, it is a known fact that some very thin people are large eaters, and also that many sufferers from obesity are small eaters. Generalization is impossible, and each case must be considered on its merits.

Obesity may be defined as a state of disordered metabolism, accompanied by superfluous adipose deposits and various functional disturbances.

Of the causes which predispose to this disease heredity plays an important part; but it is interesting to note, in the light of the treatment about to be suggested, that other states of disordered nutrition, such as rheumatism and gout, are transmitted indifferently with obesity. Another predisposing cause is some diseased blood condition, such as *anæmia* or *chlorosis*, since here the oxygenating power of the blood is deficient. Age undoubtedly plays some part, as also does sex. Women have a tendency to grow fat at the

climacteric, though the disease is often manifest in quite young girls. Men at middle age, more especially if they at this time adopt more sedentary habits, are apt to increase in weight. The question of food has already been mentioned, and it must be admitted that eating and drinking to excess may bring about an obese condition; but Bouchard distinctly lays it down that less than half (40 per cent. only) of fat people are large eaters, and that one in every ten eats less than the usual quantity of food. The same authority, on the question of exercise, calculates that 37 per cent. only of fat people take too little exercise, and that 28 per cent. take more exercise than the average person; but there is no doubt that "deficient muscular activity, by diminishing the amount of oxidation of tissue, favors obesity, especially in cases of inactivity following a period of considerable energy, the quantity of food taken remaining the same; and since, as a rule, the stouter the person the less capable is he of exercise, these two conditions react one upon the other in favor of fat production." Thus writes Sir William Allchin, and I have quoted this paragraph because it clearly enunciates the principle upon which the electrical treatment of this disease is based.

There are other causes of obesity, such as fevers, hemorrhage, cardiac disease, and alcoholism; it has also been attributed to certain drugs; but, whatever the cause, it must be looked upon pathologically as a case of deficient or delayed oxidation; that is to say, those parts of food elements which should be normally converted into CO_2 and water are stored up in the tissues as fat.

As a rule, in those cases which come to the physician for treatment, the excess of fat is due to a diminished energy of nutrition of the cell functions, and it is this that must be stimulated. This is especially true when obesity is associated with anæmia. The morbid anatomy of obesity is well known. Certain regions seem to be usually selected by this disorder,—such as the abdomen, neck, buttocks, and just below the shoulder-blades; and, if this were all, Sir William Allchin might not have laid it down that "obesity should, on the whole, be regarded as a grave matter." But the gravity of the condition lies in the fact that in the corpulent person the liver and heart are often enlarged and infiltrated with fat. The lungs are usually contracted in size, and blood changes may occur to such an extent as to be visible to the naked eye. Hence, such symptoms arise

as palpitation and dyspnoea; the latter may vary from slight breathlessness to marked difficulty in breathing. The patient is easily exhausted. There may be a feeling of faintness on exertion, or a sensation of choking, or of fulness in the chest. There is a tendency to avoid the use of the voluntary muscles, and on examination their fibres may often be seen to suffer from fatty infiltration.

There is usually a feeble precordial impulse. The sounds are weak, and the first especially may be muffled. The pulse is very variable: it is rarely quite normal, but is sometimes weak, often irregular or intermittent, occasionally very slow, the variation being due, of course, to the amount of mischief the fat has wrought in the heart structure.

The symptoms of this disease are well known, and scarcely call for mention. Most of those occasioned by the heart condition have been suggested; in addition there may be headache and attacks of giddiness. The corpulent person is usually a cheery optimist, but there may be periods of peevishness and irritability. Varicose veins and hemorrhoids occur as a direct result of the veins sharing in the generally disordered metabolism. Backache, due to the enlarged abdomen, is quite common. Gout is also common, since this is a disease caused by deficient oxidation; but these symptoms are of small importance compared with the effects of obesity upon intercurrent affections. Almost all acute diseases are unfavorably influenced by a corpulent condition, and for this reason, if for no other, should the physician do all in his power to diminish the obesity.

Therefore reduction in weight may be desirable even for those who are otherwise apparently healthy; but in some cases it may be difficult to decide whether or not to advise it. Of course, when the patient gives a general impression of advanced or extreme obesity, there is no doubt as to whether or not to advise treatment. But there are certain border-line cases with only a slight excess of fat, in which it were better to advise the patient to bear with it, and to refrain from any attempt to reduce it. These cases are chiefly observed in women who have always previously been under weight, but somewhere about the age of forty they put on weight where they least desire it. The increased fat is annoying to them, but to the ordinary observer would pass unnoted, and their weight will be found to be

about normal; they are unfavorable subjects for the electrical method about to be described,—not that it will do any harm, but that it is difficult or impossible to reduce their weight. Before describing this method of weight reduction by electricity, mention should perhaps be made of treatment by massage, Turkish and radiant-heat baths, drugs, and diet.

Massage has a great reputation for the cure of obesity, and in certain cases it may ameliorate the condition. Here it is probable that the intestines are favorably influenced, and, their atonic condition being improved, a generally better state of health supervenes. But when one recalls the number of women who have been massaged for years, the long duration of the treatment in itself speaks against its efficacy, although it is doubtless a useful adjuvant to other forms of treatment. It may be interesting in this connection to recall von Noorden's experiment, concerning which I will quote: "I once attempted to determine the effect of local massage on local fat deposits, and ordered daily massage of one arm in a stout lady; massage was given according to all the rules of the art for a period of six weeks, a treatment every day. The result was that the arm that was massaged gained one and a half centimetres in circumference, while the other arm that was not massaged retained its old dimensions."

Turkish baths and light baths, *per se*, I consider well-nigh useless as weight-reducers. True it is that one, two, or three pounds may be lost for a period of hours, but rarely for much longer. Drugs, such as thyroid, iodine, fucus vesiculosus, have their uses and their dangers, and should only be taken under careful medical advice and supervision. The same advice applies to the reduction of weight by diet, and text-books on obesity and on general medicine contain full particulars of the methods of Banting, Ebstein, Salisbury, etc.

The electrical treatment of obesity is no novelty. In July, 1909, Professor Bergonié read a paper before the Academy of Sciences upon the employment of electricity in order to provoke a general exercise—or stimulation—of the muscles of the body toward a general therapeutic end. In it he embodied the work of some nine or ten years. Since then I have had the opportunity of seeing M. Bergonié at work, of receiving many courtesies at his hands, and of studying and practis-

ing his methods; and it is his apparatus and his method, which have yielded such good results in my hands, that I am about to describe.

The axiom upon which the treatment is based may be thus stated:

The proper use of any organ increases the vitality peculiar to such organ, and also influences the vitality of the entire organization.

This general law is demonstrated particularly in the case of the muscular system; on the one hand, active exercise strengthens the muscles concerned; on the other hand, it combats the conditions in which combustion is insufficient, such as obesity and diabetes, or when incomplete, as in the uric acid diathesis.

The electrically-provoked exercise consists in the contraction of the muscles by electric stimulation some hundreds of times a minute, the aim being exercise without fatigue—a desideratum which has long been sought, and will be admitted to be of the greatest therapeutic value.

The various currents which have been tried and found wanting for this purpose, such as the direct, the high-frequency, the sinusoidal, and Leduc's current, it is not profitable now to discuss; though I would mention, *en passant*, that I think it possible that good results might be obtained with the static induced current, but the work done with this current in this disease is not sufficient to justify any positive statement.

The current finally selected, and the one which is now giving the most satisfactory results, is derived from what may be termed an induction coil, Fig. 1, *N*, or a coarse wire faradic whose coefficient of transformation is two or three (*i.e.*, four volts in the primary and eight or twelve in the secondary); below the coil are the condensers. The current is rhythmically interrupted and reversed by means of a metronome about one hundred times a minute, the aim being to obtain muscular contractions of maximum strength, with a minimum of—one cannot say pain, for there is no pain with this treatment—sensation. To accomplish this object we must have a perfect regularity of the waves, induced by the make and break of this current; they must be regular, equal, and synchronous. For, while a muscle contraction is agreeable and painless if produced by such waves, it is equally disagreeable, and even insupportable, if these waves are unequal in form or frequency. One of the requisite conditions to insure this regularity is that the interrupter must act in a perfectly

FIG. 1.



Arrangement of the electrical apparatus for the giving of the Bergonié treatment in obesity and cardiopathy. (For an explanation of the letters, see the text.)

even manner, and the old-fashioned simple ribbon interrupter, *P*, weighted at its extremity with a piece of iron, seems to give the greatest satisfaction. The length of this can be varied so as to give a musical sound of as pure a tone as possible; a little experience soon teaches this. The tone is also modified by the amount of current allowed to flow through the coil. The binding posts should be solidly fastened with screw nuts into the board, and the screw bearing the platinum point should not work too easily. When working no spark should be visible, even if the room be darkened, and this is a condition most difficult to obtain, but indispensable in order to secure painless energetic muscular contractions. A condenser of suitable capacity, properly adjusted, is of primary importance; one which could be varied would be an ideal adjunct to this apparatus. In practice the main commercial direct current is led through a resistance bank of lamps and through a circular wire rheostat, a voltmeter and an ampèremeter are put in circuit, and the current led to the coil. It is varied by means of the wire rheostat until there is no sparking in the interrupter, and the requisite musical note is heard.

The quantity of current is quite considerable, an average reading being 2.5 ampères, and $E. = 24 \text{ V.}$, the expenditure of energy in the primary being over 61 watts, which makes this apparatus—apart from its other modifications—something quite different from the faradic coil of former times. So much for the primary current.

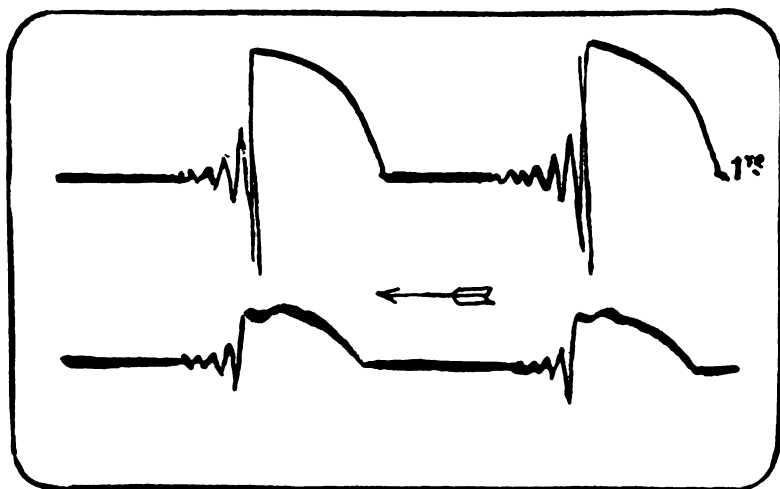
As this is intended to be a practical paper, I do not propose to deal at any length with the study of the secondary current, but I wish to reproduce two oscillographic tracings; one showing the difference between the current and interrupter when working harmoniously, and the other when the interrupter was not working regularly,—and the patient is just as well aware of the difference as you are when you see these oscillogrammes (Fig. 2).

The points to be noted are, *inter alia*, the purity and clearness of the curve, when there is no sparking at the contact point; but where the interruptions are irregular the curve is irregular. Note also the size of the curve; it is much smaller in the latter case, for, the irregularity being clearly felt by the patient, it is necessary sensibly to diminish the amount of current, and, secondly, the energy of the contractions produced. The oscillations seen after the “break” in the primary depend upon the composition of the circuit, such

factors being resistance, capacity, etc. As to the rate at which the interrupter should work, the frequency which appears to be most favorable is that of thirty times per second. These oscillogrammes which I publish (thanks to the courtesy of M. Bergonié, who made them, together with the oscillographic apparatus of M. Blondel) were also described in the *Archives d'Electricité Médicale*.

We have finished with the primary and secondary currents, and now come to the metronome, with which, as I have already said, the current is interrupted on its way to the patient. It is impossible to tetanize a muscle by the faradic current without causing pain,

FIG. 2.



Two oscillographic tracings; in the upper one the current and the interrupter are working harmoniously, while in the lower figure the converse is true.

fatigue, and even the exhaustion of the muscle. It is necessary, however, that each electrically-executed contraction of the muscle be followed by a period of rest equal in length; in a word, rhythmic currents must be applied. As a matter of fact (as an examination of the oscillogramme shows, or watching the muscular contractions proves), we do not get a symmetrical current—i.e., the efficacy of the stimulation varies with the personal factor,—the patient. But by reversing the current at each interruption we more nearly approximate regularity. The metronome is the most simple and practical apparatus for obtaining this rhythmic inversion. The wave

rheostats, which permit the progressive increase and slow decrease of the current, are not suitable for this apparatus, however useful they may be for other classes of disease, notably for wasted muscles. But here we are dealing with healthy muscles which need the most energetic work possible, and it is obvious that the muscle which is made to contract twice a second will do more work and produce a more intense combustion than the muscle which contracts only once per second. But in practice the rate which produces the best results and is most comfortable to the patient is when the metronome is regulated to 100 to 120 interruptions per minute.

Having passed through the metronome (Fig. 1, *O*), the current reaches a wall plate (*A*), which at first sight looks rather complicated. From this it is distributed to the various electrodes. In addition to the two points of entry for the current (*B*), it contains a hot wire meter (*C*) graduated from zero to 100 Ma. It also carries a rheostat (*D*) with three rows of resistance—one row of 10,000 ohms, one of 1000 ohms, and one of 100 ohms—each row being divided into tenths. Below these are twelve knife switches (*E*) controlling the polarity of the twelve electrodes—being positive if the switch be up and negative if turned down; thus many different combinations may be made. Below these again are twelve rheostats (*F*), each corresponding to one part where an electrode is applied,—*R* or *L* to back, leg, arm, abdomen, and so forth. These are simple sliding resistances with twenty stops in each, each stop being equal to 100 ohms, so that each part of the body receives that amount of electricity which it can comfortably bear. Lastly, on the lower edge of the wall plate or distributing board are the points of exit for each electrode.

Electrodes.—As the object aimed at is the simultaneous stimulation of the greatest number of muscles of the body possible, the electrodes should be of as large surface as possible. They are of two kinds—stationary and movable. The stationary electrodes used are always the same, irrespective of the size and weight of the patient; they take the form of a semireclining chair, of which they constitute the seat and back, two forming the seat (*H*), and two the back (*J*), being separated each from the other by a small space. They are made of metal, and connected with the points of exit on the wall plate. Each electrode is covered with a towel wrung out of warm water, and the patient, clothed only in a light dressing-gown,

seats himself on the chair. The movable electrodes are semi-cylindrical pieces of metal, varying in surface, form, curve, etc., and are placed with the intervening warm, wet towel on a part of the thigh (*K*), under the calf (*R*) (resting on a special support), on the abdomen and on the arms or breasts—twelve electrodes in all. The total surface covered by these electrodes is very large, and may, in some very fat people, be even 10,000 square centimetres, which would work out, with a 50 Ma. current, at 0 Ma. .01 per square centimetre. This, one can easily see, would produce only a comfortable feeling at the point of contact, and that pain is impossible. The resistance which the body offers naturally varies considerably, but Professor Bergonié has measured it, with all the electrodes well applied and well wetted, at less than 200 ohms.

The movable electrodes may be held in position in two ways—either by means of rubber bracelets, or by sacks of sand (*M*) placed on the lower limbs or abdomen of the patient, and exerting considerable pressure, which has advantages. First, it keeps the electrodes in good contact, in spite of muscular contraction; and, secondly, it gives more work to the muscles when they contract. Some fat people can be thus laden with sacks weighing up to 200 pounds, without an appreciable diminution in the electrical stimulated movements. This great weight is easily borne by the contracting muscles without fatigue and without the least painful sensation, but were it not for the passage of the electric current it would be almost insupportable.

The average current, with the electrodes arranged one pole to the back and the other pole to all the other electrodes, the metronome working, and the interrupter well regulated, I find to produce good contractions in a man of ordinary muscles, 25 to 30 Ma. being sufficient; but in very fat women with muscles poorly developed I have seen 70 to 80 Ma. registered on the meter, without the sensation being in any way painful.

The treatment should never be tiresome, but if at first it be too violent or of too long duration there will be some muscular stiffness. As a rule, it is best to begin with a treatment of twenty minutes, and increase by five minutes daily until forty or forty-five minutes is reached. Professor Bergonié in some cases advocates increasing this to sixty minutes and giving the treatment twice daily, and says

that even this is not a maximum, but naïvely adds: "It is about enough for most patients!"

It is, I hope, superfluous to point out that patients undergoing this treatment should be under continuous medical supervision. In a patient in whom great metabolic changes are daily taking place it is obvious that the medical adviser should keep a daily watch upon the patient, listening to the heart, examining the urine—especially for albumin and acetone—watching for and guarding against constipation, and in many other ways which will suggest themselves during the course of the treatment; and with this careful supervision no harm can possibly come, but benefit will certainly ensue from even a prolonged course of this electrically-excited exercise.

The patient is regularly weighed on a weighing machine (*Q*) provided for the purpose. He begins to lose weight from the first, and a feeling of alertness, of lightness, and of general well-being replaces the lethargy from which these patients so often suffer, and these effects are permanent. The influence on the general health is marked from the first, and seems to be almost out of proportion to the number of pounds lost. In very stout people the treatment should extend over a month or six weeks, during which time I have seen 20 to 30 pounds, and in one case 40 pounds lost, the patients feeling in capital health and spirits all the time, and able to work or pursue their usual vocations with added zest. The effects of this current in the treatment of obesity are immediate. I append a chart of six weeks' treatment in a fairly typical case (Fig. 3).

The diet during the treatment must vary with the individual and with what he has been in the habit of eating and drinking. *Prima facie*, with so much animal combustion going on it should merely consist of fruit, vegetables, and salad; in fact, it may be said that by the aid of this current one eats one's self, and a little salad with it. As a rule, patients take very kindly to the treatment, and after the first few days the improvement in the general appearance and health is such that they are often more anxious to make the diet more strict than to offer objections to the limitations imposed by the physician.

Although, as above stated, 20 or 30 pounds may be lost in a month or six weeks, the rate aimed at, for the sake of general permanence, is $2\frac{1}{2}$ to $3\frac{1}{2}$ pounds a week, and, as a general rule, I

advise a total reduction of 10 per cent. in one series of treatments. Within these limits the patient may be assured of absolute safety,

Fig. 3.

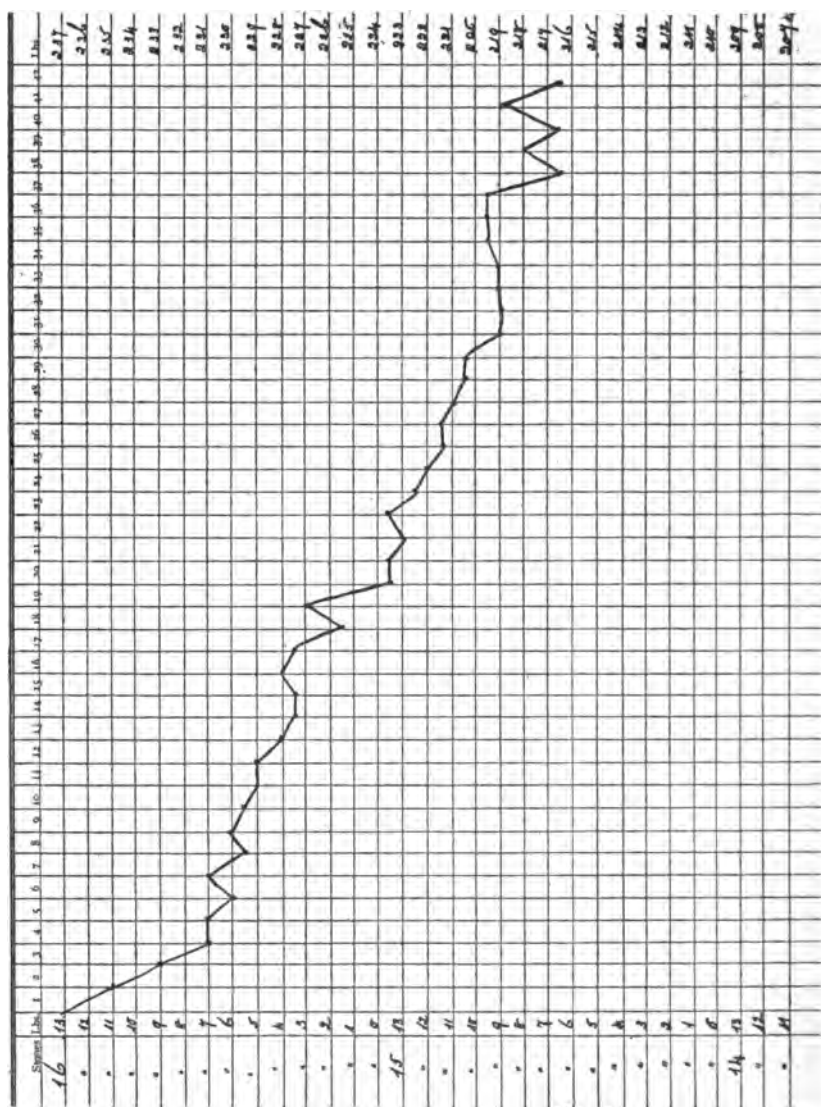


Chart showing loss of weight in a patient treated by the method of Bergonié.

and there is a feeling of increased health from the beginning, which continues throughout the treatment. Another reason for advocating a slow rate of reduction is that when fat is rapidly reduced it tends to return, whereas the slower the rate the more permanent the effect.

Yet another argument in favor of the more gradual method is that when fat is lost rapidly it is not, as a rule, lost from the abdominal walls and mesentery, where the reduction is generally most wanted; whereas, if reduction of fat can be maintained for some time, an equalization of the different fat deposits occurs, and it would appear that the excess of fat in the abdomen is gradually transported to portions of the body where there is less fat, while some disappears altogether. There remain other reasons, but I think enough has been said to show that slow methods are undoubtedly preferable.

One question constantly arises, and that is the action of this treatment on the heart. It can only be beneficial; but, as this subject was so ably handled by Dr. Hampson, I will quote from his report, and content myself with the statement that the reduction of weight by this method of treatment is one of the most valuable adjuvants to the treatment of circulatory diseases which we possess.

Where the Bergonié treatment is employed primarily for obesity it must be carefully watched for possible secondary effects upon the heart. In suitable cases of weak, irritable, and incompetent hearts the control and improvement of the circulation can be made the primary object.

The contraction of a muscle squeezes blood out of the veins in that muscle. The veins are provided with valves which prevent the blood from flowing in one direction, and allow it only to flow in the other. Thus every contraction of the muscle drives blood out of it, and always in the same direction,—that is, toward the heart. Under the stimulation of Bergonié's apparatus a number of large muscles contract at the same time, and all at the same time send a wave of blood toward the heart. This is repeated at every beat of the metronome. Thus one result of the treatment, which accounts for some of its good effects, already described, is the powerful assistance it gives to the circulation by reducing in the veins the pressure against which the capillaries have to deliver their contents, and so indirectly reduces the pressure against which the heart has to jump.

A further, and very remarkable, effect is produced by a special timing of the contractions. If they are arranged to take place at almost exactly the same speed as that at which the patient's heart beats, the heart's action after a time will often be found to have so adjusted itself as to be exactly synchronous with the rhythmical con-

tractions. If these contractions be arranged at a somewhat slower speed than the heart-beat, the latter is soon reduced to the same slower speed. Thus it is frequently possible to control and regulate an excessively rapid beat.

In all other respects the influence of this treatment upon the patient can be nothing but beneficial. The reinforcement of the circulation increases the activity of all the functions which depend upon a good circulation. In particular, distress in breathing is markedly relieved, and the patient enjoys a sense of well-being and comfort which lasts for several hours, and becomes increasingly distinct and lasting by repetition.

At the same time that better circulatory work is being done, the heart is exerting itself less in doing it, owing to the assistance it derives from the contractions of the body muscles, which, being stimulated rhythmically, and in synchronism with the heart itself, may be described as so many subsidiary hearts. The heart is, therefore, in a state of rest which conduces to recovery of tone and strength. Patients with dilated, rapid, and irritable hearts, who had previously gone for treatment to Nauheim, and derived much benefit therefrom, find that this application of the Bergonié method of stimulation more promptly controls the heart, and have preferred to remain under its influence at home, where the dilated heart has undergone a notable reduction in size. It is almost needless to say that the treatment must be given with great caution and with constant regard to the patient's condition, which must be most carefully watched.

In order to bring the subject matter of this article up to date, I should like to quote briefly from three communications made to the 41st Congress of the "Association Française pour l'Avancement des Sciences," held at Nimes last summer (1912). The first dealt with the effect on blood-pressure of this treatment, and was by Professor Bergonié himself, and may be summarized:

The blood-pressure of the individual depends upon so many different factors, temporary and permanent, that to connect any alteration in it to one physiotherapeutic measure, whatever it may be, would not appear to be scientific. However, when this measure has been in use for some time, and when profound change follows it, and even a complete alteration in the whole of the organism, as in

the cure of obesity, it is allowable to acknowledge, or at least to enquire, whether there be not the relation of cause and effect between alteration in the arterial tension and the physiotherapeutic measure employed. This is what the author claims for his method of the cure of obesity by electrically-stimulated muscles. The following statistics are derived from 30 cases which were under very careful observation and which he divides into four categories:

- (1) Those with very high tension; *i.e.*, above 25 cm. Hg.
- (2) Those with fairly high tension; *i.e.*, between 21 and 25 cm. Hg.
- (3) Those with normal tension; *i.e.*, about 17 cm. Hg.
- (4) Those with low tension; *i.e.*, below 10 cm. Hg.

The results were as follows:

- (1) Those with very high tension were lowered 5.98 cm.
- (2) Those with fairly high tension were lowered 2.45 cm.
- (3) Those with normal tension were lowered 1.6 cm.
- (4) In those whose tension was subnormal there was a rise of 0.3 cm.

"It is difficult to explain these figures. The mystery will be solved later."

The second paper was by M. Laquerriere and others. In this the authors give a summary of the method and, in support of its value, report the case of an elderly woman who for many years had gone from hospital to hospital in Paris without relief. The case had been shown as one of Dercum's disease (*adiposa dolorosa*); the patient was absolutely incapable of voluntary movement. She entered the hospital under the care of M. Labbé, and was placed on a strict diet, on which at first she lost weight, but it subsequently remained stationary. Then the Bergonié treatment was commenced; on account of the extreme weakness of the patient, only very small doses were employed. There was decrease in weight from the first, the painful sensations disappeared, and the general condition sensibly improved. At the end of two months the patient ceased to lose weight; she was given thyroid gland, and the electrical treatment continued until the weight again began to diminish. Altogether, during the three months the patient lost about 200 grammes a day (47 pounds in all). One interesting point is that during the three weeks after the Bergonié treatment was stopped the patient con-

tinued the diet and the thyroid gland, and was able to take voluntary exercise, but the weight remained the same.

M. Marcel Labbé pointed out that one could deduce from this report the fact that for the corpulent who can become thinner only by exercise, and who through some reason or other are unable to take exercise, the Bergonié method meets a want which no other treatment can supply.

And, lastly, M. Maurice Fauré pointed out that exercise fatigues us by

- (1) Muscular work.
- (2) Using the nervous system.
- (3) Using the brain.

An individual, for example, perhaps refrains from some exercises which we have prescribed for him because his nervous centres are incapable of making the voluntary effort necessary. This often happens in the case of the corpulent. The great originality of the Bergonié method is that the muscular system alone is called into action while the nervous and cerebral systems are at rest, hence fatigue of these systems is prevented. This makes the method a novel system, and a procedure without a parallel.

INDEX TO VOLUME III

(TWENTY-THIRD SERIES)

A

- Abrams, Albert, A.M., M.D., Treatment of diseases of the heart, 108
 Adrenalin in pneumonia, 66
 Alcohol in pneumonia, 59, 61
 Alopecia areata, diagnosis and treatment of, 151
 Altofrequent cytolysis, 270
 scintillation, 270
 Ammonia in pneumonia, 59, 63
 Anæmia from a surgical standpoint, 227
 Angina pectoris, heart-reflexes in, 113
 Antibacterial sera in pneumonia, 82
 Apoplexy, pulmonary, 139
 Appendicitis, differential diagnosis from duodenal and gastric ulcers, 101
 Ashford, Bailey K., M.D., Sc.D., Remarks on a clinical study of uncinariasis and its treatment, 28
 Ashhurst, Astley P. C., M.D., Acute osteomyelitis of the lumbar vertebrae, death from pyæmia, 214
 Asthma, bronchial, 129
 Atelectasis, pulmonary, 134
 Atropine in pneumonia, 59, 72

B

- Bainbridge, William Seaman, A.M., Sc.D., M.D., The use of certain agents in the treatment of cancer and allied diseases: (1) electrocoagulation (Doyen); (2) fulguration (de Keating-Hart); (3) thermoradiotherapy (de Keating-Hart), 268
 Baruch, Simon, M.D., The treatment of pulmonary tuberculosis by hydrotherapy, 116
 Baudet, P., M.D., The use of camphorated oil in surgery, 224
 Bergonié treatment of obesity and cardiopathy, 286
 Betanaphthol in uncinariasis, 38, 40
 Bipolar voltaisation, 273
 Bleeding in pneumonia, 64, 68
 Blood-pressure in pneumonia, 66
 Bronchial asthma, 129
 stenosis, 133
 Bronchiectasis, 127
 Burditis, subacromial, 205
 Byford, Henry T., M.D., Anæmia from a surgical standpoint, 227

C

- Caffeine in pneumonia, 57, 66
 Camphor in pneumonia, 59
 Camphorated oil in surgery, 224
 Cancer of stomach and intestine, differential diagnosis for duodenal and gastric ulcers, 101
 Cardiac reflexes, 108
 Cardiopathy, Bergonié treatment of, 286
 Carriers, malarial, 11, 27
 Castaigne, J., M.D., Hypochlorhydria and its treatment, 146
 Cauterisation, 270
 Chemotherapy in pneumonia, 88
 Cholelithiasis, differential diagnosis from duodenal and gastric ulcers, 100
 Cocaine in pneumonia, 58, 66
 Coccyx, fracture of, 209
 Congestion of the lung, active, 135
 hypostatic, 137
 obstructive, 136
 Craig, Charles F., M.D., The prophylaxis and treatment of malarial infections, 1
 Cytolysis, altofrequent, 270

D

- Daniel, Peter, F.R.C.S. (Eng.), Gastro-intestinal toxæmia: its causes, symptoms and treatment, with a criticism of intestinal stasis (Lane), 159
 Desiccation, 270
 Diathermy, 272
 Digitalis in heart disease, 109
 pneumonia, 52, 66
 Diagnosis and Treatment, Department of:
 Diuretics, the newer medicinal and non-medicinal, 142
 Duodenal ulcers, diagnosis and treatment of, 95
 Gastric ulcers, diagnosis and treatment of, 95
 Heart, treatment of diseases of the, 108
 Hydrotherapy in the treatment of pulmonary tuberculosis, 127
 Hypochlorhydria and its treatment, 146
 Malarial infections, prophylaxis and treatment of, 1
 Parasitic diseases of the skin, treatment of, 151

Diagnosis and Treatment, Department of:
Pneumonia, on the treatment of, 42
Pulmonary diseases, practical points in the management of same, 127

Skin, treatment of some of the parasitic diseases of, 151

Tuberculosis, pulmonary, treatment of by hydrotherapy, 127

Uncinariasis, remarks on a clinical study of, and its treatment, 28

Diuretics, the newer medicinal and non-medicinal, 142

Doyen's electrocoagulation, 268

Duodenal ulcers, diagnosis and treatment of, 95

E

Eczema marginatum, 157

Effluviation, 270

Electrocoagulation (Doyen), 268, 279

Electrotherapeutics, Department of:
Bergonié treatment of obesity and cardiopathy, 286

Physical agents in the treatment of cancer and allied conditions, 268

Eosinophiles in uncinariasis, 37

Ethyl-cuprein-hydrate in pneumonia, 88, 94

F

Fulguration (de Keating-Hart), 268, 270, 273

G

Gastric ulcers, diagnosis and treatment of, 95

Gastro-intestinal toxæmia, 159

Glass dressing, liquid, 213

Gonococcus, examination for, 254

Guaiacol in pneumonia, 75

Gwyn, Norman B., M.B., On the treatment of pneumonia, 42

H

Heart, treatment of diseases of the, 108

Hernia of tibialis anticus muscle, 212

Huber, John Bessner, A.M., M.D., Practical points in the management of some pulmonary diseases, 127

Humphris, Francis Howard, M.D.(Brux.), F.R.C.P.(Edin.), M.R.C.S.(Eng.), L.R.C.P.(Lond.), L.M. (Rot. Dublin), Bergonié treatment of obesity and cardiopathy, 286

Hunchback, lung in the, 135

Hydrotherapy in pneumonia, 63, 74
treatment of pulmonary tuberculosis by, 116

Hyperchlorhydria and duodenal ulcers, 96, 103

Hypochlorhydria and its treatment, 146

I

Immunity, active, in pneumonia, 84

passive, in pneumonia, 82

Infarct, hemorrhagic, 139

Interesting surgical cases, 204

Intestinal stasis (Lane), 159

J

Jiu-Jitsu, 112

K

Knowles, Frank Crozer, M.D., Treatment of the common vegetable parasitic diseases of the skin, 151

Kuatsu, 112

L

Lane's intestinal stasis, 159

Leg ulcers, 210

Leucocytic extracts in pneumonia, 87

Linn, Thomas, M.D., The newer medicinal and non-medicinal diuretics, 142

Liquid glass dressing, 213

Lobar pneumonia, 140

Lumbar vertebrae, acute osteomyelitis of, 214

M

Malaria, æstivo-autumnal, 22

quartan, 22

tertian, 22

Malarial carriers, 11, 27

infections, the prophylaxis and treatment of, 1

education of the public in, 15

isolation of the infected individual in, 8

prophylaxis, 17

treatment of, 19

Male fern, uselessness of, in uncinariasis, 40

Medicine, Department of:

Alimentary toxæmia, 201

Gastro-intestinal toxæmia, 159

Medicolegal, Department of:

Rape in children and in young girls, 245

Mosquito, destruction of, 3

protection of man from bites of, 7

N

"Necator Americanus," 28

Nauhelm baths in heart disease, 110

O

Obesity, Bergonié treatment of, 286

Oedema, pulmonary, 138

Oscillatory desiccation, 271

Osteomyelitis, acute, of the lumbar vertebrae, 214
Osteoperiostitis of finger, 207
Oxygen in pneumonia, 68

P

Pancreatic disease, differential diagnosis from duodenal and gastric ulcers, 102
Parasitic diseases of the skin, treatment of, 151
Peritonitis, treatment of acute, 234
Pituitrin in pneumonia, 66
Plantaris tendon, rupture of, 212
Pneumonia, lobar, 140
 on the treatment of, 42
Porto Rico and uncinariasis, 28
Pregnancy, diagnosis of, 245
Pulmonary apoplexy, 139
 atelectasis, 134
 diseases, practical points in the management of same, 127
 oedema, 138
Pylephlebitis, suppurative, 240

Q

Quinine, action of, on the malarial plasmodia, 20
 and urea in pneumonia, 89, 93
 contra-indications to the use of, 25
 in pneumonia, 75, 88
 subcutaneous administration of, 24

R

Rape in children and in young girls, 245
Reed, Boardman, M.D., The diagnosis and treatment of gastric and duodenal ulcers, 95
Rickets, 201
Ringworm, diagnosis and treatment of, 151
Robins, Charles R., Suppurative pylephlebitis, 240

S

Salicylates in pneumonia, 75
Salicylate of sodium as a diuretic, 144
Schott method in treating affections of the heart, 110
Scintillation, infrequent, 210
Scurvy, 173
Silver in pneumonia, 88
Skillern, P. G., M.D., Interesting surgical cases, 204
Skin, treatment of some of the parasitic diseases of, 151
Sodium silicate dressings, 213
Soft palate, perforated ulcer of, 204
Sporotrichosis of forearm, 208
Stenosis, bronchial and tracheal, 133
Strophanthin in heart disease, 110
Strychnine in pneumonia, 56, 66, 71
Subacromial bursitis, 205
Suppurative pylephlebitis, 240

Surgical cases, interesting, 204
Surgery, Department of:
 Anæmia from a surgical standpoint, 227
 Camphorated oil in surgery, 224
 Interesting surgical cases, 204
 Osteomyelitis, acute, of the lumbar vertebrae, 214
 Peritonitis, treatment of acute, 234
 Pylephlebitis, suppurative, 240

T

Tcha-Tchin, 113
Tenosynovitis of thumb, 206
Theobromine as a diuretic, 144
Thermopenetration, 270, 272
Thermoradiotherapy (de Keating-Hart), 268, 283
Thomas, C. P., M.D., The treatment of acute peritonitis, 234
Thumb, sessile wart of, 209
 tenosynovitis of, 206
Thymol in uncinariasis, 38, 40
Tibialis anticus muscle, hernia of, 212
Tinea circinata, 156
 cruris, 157
 versicolor, 158
Tongue, tuberculous ulcer of, 205
Toxæmia, alimentary, 201
 gastro-intestinal, 159
Tracheal stenosis, 133
Transthermy, 272
Tuberculosis, pulmonary, treatment of, by hydrotherapy, 116
Tuberculous ulcer of tongue, 205

U

Ulcer, leg, 210
Ulcers, duodenal, diagnosis and treatment of, 95
 gastric, diagnosis and treatment of, 95
 peptic, 98
 tuberculous, of tongue, 205
Uncinariasis, remarks on a clinical study of, and its treatment, 28
Urea and quinine in pneumonia, 93

V

Vaccines, 200
Vaccines in pneumonia, 84
Venereal disease, examination for, 250
Veratrum viride in pneumonia, 88
Voitaization, bipolar, 273

W

Wadsworth, William H., Acute osteomyelitis of the lumbar vertebrae, 214
Wart, sessile, of thumb, 209
Williams, Gurney, M.D., Rape in children and in young girls, 245

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